MJTD

Thilawa Special Economic Zone (Zone B) Development

Environmental Monitoring Report Phase-2 & 3 (Construction Phase)

Myanmar Japan Thilawa Development Limited.

June 2019

CONTENTS

Appendix

1. Executive Summary

The environmental inspection and compliance monitoring program will be implemented under the direction of Ministry of Natural Resources and Environmental Conservation (MONREC) with oversight by Thilawa SEZ Management Committee.

The monitoring record from September 2018 to November 2018 according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 10, 10.1 Table 10.1-2 and 10.2, Table 10.2-2 Content of the EIA Report of Thilawa SEZ Development Project (Zone B).

2. Summary of Monitoring Activities

a) Progress made to date on the implementation of the EMP against the submitted implementation schedule;

We submitted EMP for TSEZ Zone-B as following table.

Report No.	Description	Phase	Submission
1	Environmental Monitoring Report	Phase-1 Pre-construction Phase	March, 2017
2	Environmental Monitoring Report	Phase-1 Construction Phase	June, 2017
3	Environmental Monitoring Report	Phase-1 Construction Phase	September, 2017
4	Environmental Monitoring Report	Phase-1 Construction Phase	December, 2017
5	Environmental Monitoring Report	Phase-2 Pre-construction Phase	December, 2017
6	Environmental Monitoring Report	Phase-1&2 Construction Phase	March, 2018
7	Environmental Monitoring Report	Phase-1&2 Construction Phase	June, 2018
8	Environmental Monitoring Report	Phase-1&2 Construction Phase	September, 2018
9	Environmental Monitoring Report	Phase-3 Pre-construction Phase	December, 2018
10	Environmental Monitoring Report	Phase-2&3 Construction Phase	March, 2019
11	Environmental Monitoring Report	Phase-2&3 Construction Phase	June, 2019

Report (No.11 is submitted this day attached with Construction Phase implementation schedule. Subsequent Construction Phase reports will be submitted on Quarterly.

b) Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;

None

c) Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;

- Depend on the exceeding parameters and situation

d) Accidents or incidents relating to the occupational and community health and safety, and the environment:

Neither accidents nor incidents happen during this monitoring period.

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e) Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.

Please refer to the attached Environmental Monitoring Form.

3. Construction Progress

Thilawa SEZ Zone B Development Project construction activities is submitted enclosed with monthly progress reports from contractor in Appendix E to G.

E. Monthly Progress Report for March, 2019

F. Monthly Progress Report for April, 2019

G. Monthly Progress Report for May, 2019

4. Monitoring Result

Environmental Monitoring Plan report for construction phase implemented according to the following table, reference on Table 10.2-2, Chapter 10, EIA for Industrial Area of Zone-B.

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	Construction site (1 point)	Once/ 3month	March 2019, Air Quality Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD_5, COD, coliforms, oil and grease, chromium	- Over flow of construction site to the creek (at least 3 sampling points/ mixing point: i) discharge water, ii) upstream water and iii) downstream water - Well near the construction site (1 point)	Once/ 2 month	April 2019 Water and Wastewater Quality Monitoring Report
Waste	Amount and kind of solid waste	Construction site	Once/ 3 month	Monthly Progress Reports (March, April, May 2019)
Noise and Vibration	- Noise and vibration level - Traffic Count	Preservation area such as residence around the proposed construction site (at least 1 point)	Once/ 3 month (peak period)	Noise and Vibration Monitoring Report March 2019 Traffic Count Monitoring Report March 2019
		Preservation site such as residence along the route for on-site vehicles (1 point for noise and vibration and 2 points for traffic count)		
Ground Subsidence	- Ground water level - Ground elevation level - Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (March, April, May 2019)
Hydrology				
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (March, April, May 2019)
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Construction site	Once/ month	

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Category	Item	Location	Frequency	Remark
Accident	Existence of accident	Construction site	As occasion arise	

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Environment Monitoring Form

Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-Construction Phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Industrial Area of Zone B). Should there be any changes to the original plan, such change shall be reviewed and evaluated by environmental expert.

(1) General

1) Phase of the Project

- Please mark the current phase.

☐ Pre-Construction Phase ☑ Construction Phase ☐ Operation Phase

2) Obtainment of Environmental Permits

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Approved letter for Environmental Impact Assessment (EIA) Report of Industrial Area, Thilawa Special Economic Zone (Zone-B)		29th December 2016	Thilawa SEZ Management Committee	
Notification of the comments of Ministry of Natural Resources and Environmental Conservation regarding with the Standard Change of Wastewater Quality of Industrial Zone, Internal Regulations of Thilawa SEZ Zone-A and Zone-B	5th January 2018	10th January 2018	Thilawa SEZ Management Committee	

3) Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period	Duration of Report Period	Frequency
Number and contents of formal comments made by the public			Upon receipt of comments/ complaints
Number and contents of responses from Government agencies			

(2) Monitoring Results

1) Ambient Air Quality (March 2019)

NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*1	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
AQ-1	NO_2	mg/m³	0.098	0.105	0.2 mg/m³ (1 Hour)	0.1 mg/m³ (24 Hour)	-	One time / 3 months	Haz-Scanner EPAS	Refer to air quality report
	SO_2*2	mg/m³	0.215	0.283	0.02 mg/m³ (24 Hours)	0.02 mg/m³ (24 Hours)	-			
	CO	mg/m³	0.167	0.197	-	10.26 mg/m³ (24 Hours)	-			
	PM2.5*3	mg/m³	0.104	0.117	0.025 mg/m³ (24 Hours)	0.025 mg/m³ (24 Hours)	-			
	PM10*3	mg/m³	0.174	0.193	0.05 mg/m³ (24 Hours)	0.05 mg/m³ (24 Hours)	-			

*1**Remarks:** Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-1), Reference to the air quality monitoring report (March 2019)

*[2]**Remark:** The result of SO2 in AQ1 is excess than target value due to four expected reasons i) combustion of fuel for vehicle from nearby roads ii) operation activities of Myanmar International Terminal Thilawa Port iii) operation activities of local industrial zone iv) construction activities of Zone B. Total exceeding hour is 84 hours during construction period, 12 hours are come from Zone-B and 72 exceeded hours are come from outside of Zone-B. And then according to summary of wind direction at AQ-1, 82.1% are come from outside of Zone-B and 17.8% are come form inside of Zone B.

*[3]**Remark:** The result of PM 2.5 and PM 10 are excess than target value due to three expected reasons i) dust from unpaved land area from outside of Zone-B ii) transportation in and around the monitoring area iii) construction activities of Zone-B.

Complaints from Residents

- Are there any complaints from residents regarding air quality in this monitoring period? ☐ **Yes** ☑ **No**

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

2) (a) Water Quality – April 2019

Measurement Point: Effluent of Wastewater (SW-2 and SW-4 are attached as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. SW-7 is the main discharging point. GW-2 is also as reference point for monitoring of existing tube well located in the Monastery Compound near Zone-B area)

- Are there any effluents to water body in this monitoring period? ☐ **Yes,** ☑ **No**

If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard

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Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
SW-2 (reference point)	Temperature	°C	27	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	8.26	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L	82	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.78	-	-		Instrument Analysis Method	
	BOD_5	mg/L	6.44	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	70	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	Refer to water quality report
	Total Coliform*4	MPN/100 ml	>160,000	400	400	Once per 2 months	APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease		<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS)*7	mg/L	4462.00	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*7	mg/L	3.282	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*7	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
SW-4 (reference point)	Temperature	°C	26	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.73	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L	80.0	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.76	-	-		Instrument Analysis Method	
	BOD_5	mg/L	4.86	50	20		APHA 5210 B (5days BOD Test)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	COD_{Cr}	mg/L	31.4	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	Refer to water quality report
	Total Coliform*4	MPN/100 ml	2,100	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS) *7	mg/L	7034.00	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*7	mg/L	2.578	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*7	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
SW-7	Temperature	°C	32	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	Refer to water quality report
	pH	-	8.73	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	20	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.79	-	-		Instrument Analysis Method	
	BOD_5	mg/L	6.38	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	32.6	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100 ml	540	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Total Dissolved solids (TDS) *7	mg/L	4912.00	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*7	mg/L	0.568	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*7	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
GW-2 (reference point)	Temperature	°C	25	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.5	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	2.00	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.38	-	-		Instrument Analysis Method	
	BOD_5	mg/L	0.15	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	< 0.7	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	Refer to water quality report
	Total Coliform*5	MPN/100 ml	3,300	400	400	Once per 2 months	APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤ 0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS) *7	mg/L	146.00	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*6, *7	mg/L	5.456	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*7	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	

*1Remark: Reference to the Water and Wastewater Quality Monitoring Report (April 2019)

*2Remark: Referred to the National Emission Quality Guideline (NEQG) 29th December 2015

*3Remark: For the monitoring point of SW-2 and SW-4, the result of SS exceeded than the target value due to three expected reasons of i) soil erosion caused by construction of factories in Zone-B and eroded soil particles may contain soluble compounds that can dissolve in water ii) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and iii) influence by water from the downstream of monitoring points due to flow back by tidal fluctuation.

*4Remark: For the monitoring point of SW-2, SW-4 and SW-7, the result of total coliform exceeded than the target value due to three expected reasons i) natural bacteria existed in discharged creek because there are various kinds of vegetation of creature such as birds, and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect. Total coliforms do not affect human health directly, self-monitoring was carried out to identify health impact by coliform bacteria. As for the result of E-Coli SW-2 was none, SW-4 was none and SW-7 was 6.8. It is considered that there is no significant impact to human health.

*5 Remark: For the monitoring point of GW-2, the result of total coliform exceeded than the target value due to i) the poor maintenance of well which can increase the risk of bacteria and other harmful organisms ii) the well was not operated regularly and was not use for long time.

*6 Remark: For the monitoring point of GW-2, the result of iron exceeded than the target value due to i) corrosion of pipes because the water is pumped through the iron pipelines buried underneath the ground.

*7Remark: Recommendation from JICA Environmental expert (TSMC) , to be more emphasized on Environmental and analyzing only.

3) Soil Contamination (only operation phase)

Situations environmental report from tenants

- **Are there any serious issues regarding soil contamination in this monitoring period?** ☐ **Yes,** ☑ **No**

If yes please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

4) Noise Level (March 2019)

Location	Item	Unit	Measured	Measured	Country's	Target	Referred	Frequency	Method	Note

			Value (Mean)	Value (Max)	Standard	value to be applied*	International Standard			(Reason of excess of the standard)
Residential Area NV-2	Leq (day)	dB(A)	62	55	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	48	54		60				
	Leq(night)	dB(A)	46	53		55				
Along the road (NV-1)	Leq (day)	dB(A)	62	62		75				
	Leq(night)	dB(A)	51	56		70				

***Remarks:** Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-8), Reference to the noise and vibration monitoring report (March 2018)

Complaints from Residents

- Are there any complaints from residents regarding noise in this monitoring period? ☐ Yes, ☑ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

5) Solid Waste

Measurement Point: Construction Site (Construction Phase), Storage for Sludge (Operation Phase)

Are there any wastes if sludge in this monitoring period? ☑ Yes, ☐ No

If yes, please report the amount of sludge and fill in the results of solid waste management activities.

Item	Date	Generated from	Unit	Value	Solid Waste Management Activities

Amount of Sludge	4-May-2019	Construction Waste	Loads	3	Waste disposing to authorized waste collector (YCDC)

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
7-March-2019	120	m^3/ week	+ 6.300	m	
14-March-2019	112	m^3/ week	+ 6.297	m	
21-March-2019	98	m^3/ week	+ 6.298	m	
28-March-2019	99	m^3/ week	+ 6.299	m	

Remarks: Reference to Monthly Progress Report (March-2019)

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
4-April-2019	112	m^3/ week	+ 6.300	m	
11-April-2019	105	m^3/ week	+ 6.297	m	
18-April-2019	123	m^3/ week	+ 6.298	m	
25-April-2019	128	m^3/ week	+ 6.299	m	

Remarks: Reference to Monthly Progress Report (April-2019)

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
9-May-2019	114	m^3/ week	+ 6.298	m	

16-May-2019	103	m^3/ week	+ 6.299	m	
23-May-2019	95	m^3/ week	+ 6.301	m	
30-May-2019	115	m^3/ week	+ 6.302	m	

Remarks: Reference to Monthly Progress Report (May-2019)

7) Offensive Odor (only operation phase)

Complaints from Residents

- Are there any complaints from residents regarding offensive odor in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

Situations environmental report from tenants

- Are there any serious issues regarding offensive odor in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

8) Infectious disease, Working Environment, Accident

Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

Note: If emergency incidents are occurred, the information shall be reported to the relevant organizations and authorities immediately.

9) Resettlement Works for Project Affected Persons (PAPs) and Common Assets

Information from TSMC

- Please describe the progress and remarkable issues (if any) to fill in below the table.

Resentment Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	The number of PAHs who got land compensation; • 2 PAHs from Zone B (Area 2_1 Ex 2) The number of PAHs who already relocated; • 3 PAHs from Zone B (Area 2_1 Ex 2) and 1 PAH from Zone B (Area 3_1) The number of PAHs who got cultivation compensation and already relocated; • 1 PAH from Zone B (Area 2_1 Ex 2)	
	Income Restoration Program	1) Conducted quarterly monitoring survey for Valuable People Program in March and June'19 2) Supporting for Valuable People Program at Zone B for every month 3) Drainage renovation at Zone B in June'19 4) Conducted TCMP roll out at Aye Mya Thida village in	

		June'19 5) Provided basic and advance tailoring training to Zone B PAP from April to June 2019	
Common Assets	Relocation		

- **Are there any grievances submitted, solved and pending regarding resettlement works?** ☑ Yes, ☐ No
  If yes, please describe the contents of grievances to fill in below the table.

Contents of Grievance	Response/ Countermeasures
There were **5** grievances received during March to June 2019. The Number of Complaints under "Compensation" category is **1**, "Environment" category is **2** and "Employee and Worker Behavior" category is **2**.	Among 5 grievances, 2 complaints had been resolved and 1 is under investigation concerns and the left 2 is under investigation on track.

10) CSR activities such as Community Support Program

- **Are there any CSR activities implemented in this monitoring period?** ☑ Yes, ☐ No

If yes, please describe the outline of CSR activities implemented to fill in below the table.

Date	Activities	Description (Location, Participant etc)
March 2019	Free Drawing Course	Aye Mya Thida School
April 2019	Homage Paying Ceremony	Moe Gyo Swan Monastery
May 2019	Selection of Scholarship	Aye Mya Thida School
May 2019	Stationary Donation Program	Moe Gyo Swam Monastery
June 2019	School Handover Ceremony	Aye Mya Thida School

June 2019	Factory Visit to TSEZ	Ace Cook Industry
June 2019	H1N1 Awareness Talk and TCMP Roll out	Aye Mya Thida Village

End of Document

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Water and Waste Water Monitoring Report

April 2019

WATER QUALITY MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

IN THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

April 2019

Myanmar Koei International Ltd.

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

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CHAPTER 1: INTRODUCTION

1.1 General

Thilawa Special Economic Zone (SEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area. As for the monitoring of the water quality, total four sampling points are set for water quality survey, named SW-2, SW-4, SW-7, and GW-2 have been monitored in Thilawa SEZ and its surrounding area in timely manner. Among the four locations, SW-7 is main discharged point of Zone B during the construction stage. Moreover, GW-2 is monitored as a reference of existing tube well which located in the monastery compound of Phalan village. Location of sampling points for water quality monitoring is shown in Figure 1.1-1.

Figure 1.1-1 Location of Sampling Points of Water Quality Monitoring

CHAPTER 2: WATER QUALITY MONITORING

2.1 Monitoring Items

Sampling points and parameters for water quality monitoring are determined to cover the environmental monitoring plan of the EIA report.

Water quality sampling was carried out at four locations. Among the four locations, water flow measurement was carried out at one location (SW-4) where can be measured by current meter. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

No.	Parameters	SW-2	SW-4	SW-7	GW-2	Remarks
1	pH	○	○	○	○	On-site measurement
2	Water Temperature	○	○	○	○	On-site measurement
3	DO	○	○	○	○	On-site measurement
4	$BOD_{(5)}$	○	○	○	○	Laboratory analysis
5	$COD_{(Cr)}$	○	○	○	○	Laboratory analysis
6	Suspended Solids	○	○	○	○	Laboratory analysis
7	Total Coliform	○	○	○	○	Laboratory analysis
8	Oil and Grease	○	○	○	○	Laboratory analysis
9	Chromium	○	○	○	○	Laboratory analysis
10	Total Dissolved solids (TDS) (Self-monitoring)	○	○	○	○	Laboratory analysis
11	Iron (Self-monitoring)	○	○	○	○	Laboratory analysis
12	Mercury (Self-monitoring)	○	○	○	○	Laboratory analysis
13	Escherichia Coli (Self-monitoring)	○	○	○	○	Laboratory analysis
14	Flow Rate	-	○	-	-	On-site measurement

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

The outline of sampling points is mentioned in Table 2.2-1. The photos of conducting field survey at each sampling points are mentioned in Appendix-1.

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	**Coordinate**- N - 16° 40' 20.69", E - 96° 17' 18.04"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling.
2	SW-4	**Coordinate**- N - 16° 39' 42.84", E - 96° 16' 27.42"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling and water flow rate measurement.
3	SW-7	**Coordinate** - N - 16° 40' 13.25", E - 96° 17' 5.66"
		Location – Outlet of retention pond of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item - Discharge water sampling.
4	GW-2	**Coordinate** - N - 16° 39' 25.30", E - 96° 17' 15.60"
		Location - In the monastery compound of Phalan village
		Survey Item - Ground water sampling.

Source: Myanmar Koei International Ltd.

SW-2 (Reference Point)

SW-2 was collected at the upstream of Shwe Pyauk creek. This sampling point is located at the northeast of Zone B area and at the south of Dagon-Thilawa road. The surrounding areas are Zone A in the northwest and local industrial zone in the east respectively.

SW-4 (Reference Point)

SW-4 was collected at the downstream of Shwe Pyauk creek, after mixing of discharge water from local industrial zone, construction site of Zone B and Zone A, which is flowing from east to west and then entering into the Yangon River. This sampling point is located in the west of Zone B area and in the south of Dagon-Thilawa road. The surrounding areas are Zone A in the northeast, local industrial zone in the east and paddy fields in the south and west respectively.

SW-7 (Discharged Point)

SW-7 is main discharged point of Zone B during construction stage. This sampling point is located at outlet of retention pond of Zone B construction site, in the north of Zone B area and in the south of Dagon-Thilawa road. The surrounding areas are Zone A in the north and local industrial zone in the east respectively.

GW-2 (Reference of Existing Tube Well)

GW-2 was collected from tube well as ground water sample. It is located in the monastery compound of Phalan village. The surrounding areas are Thilawa SEZ Zone A in the north, Phalan village in the south and fields in the west and local industrial zone in the northeast, and construction of Thilawa SEZ Zone B in the east and northeast respectively.

2.3 Monitoring Method

All water samples were collected with cleaned sampling bottles and analyzed by the following standard method as shown in Table 2.3-1. All samples were kept in iced boxes keeping at 2-4 °C and were transported to the laboratory. Among the parameters; water temperature, pH and DO were measured by the on-site instrument "Horiba, U-52" and water flow rate was also conducted by using the on-site instrument "Tamaya Digital Current Meter".

Table 2.3-1 Analytic Method for Water Quality

No.	Parameter	Method
1	Temperature	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
2	pH	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
3	Dissolved Oxygen (DO)	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
4	$BOD_{(5)}$	APHA 5210 B (5 days BOD Test)
5	$COD_{(Cr)}$	APHA 5220D (Close Reflux Colorimetric Method)
6	Suspended Solids (SS)	APHA 2540D (Dry at 103-105°C Method)
7	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)
9	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
10	Total Dissolved solids (TDS)	APHA 2540C (Total Dissolved Solids Dried at 180.C)
11	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
12	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
13	Escherichia Coli	APHA 9221 F (Escherichia Coli Procedure Using Fluorogenic Substrate)
14	Flow Rate	Detection of Electromagnetic Elements (Real-time measurement by UC-200V Digital Current Meters)

Source: Myanmar Koei International Ltd.

2.4 Monitoring Period

Water quality and water flow rate monitoring were conducted on 24 April 2019 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 24 April 2019 is shown in

Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	24/04/2019 12:37
2	SW-4	24/04/2019 09:07
3	SW-7	24/04/2019 12:56
4	GW-2	24/04/2019 13:30

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
24/04/2019	02:59	0.50	Low Tide
	07:42	5.19	High Tide
	14:35	0.71	Low Tide
	19:48	5.45	High Tide

Source: Myanmar Port Authority, Tide Table for the Yangon River and Elephant Point, 2019

2.5 Monitoring Results

Results of water quality monitoring at discharged point and discharged creek are summarized in

Table 2.5-1. Analytical results of the laboratory are described in Appendix-2, Appendix-3 and Appendix-4. The results were compared with the target value of effluent water quality discharged to water body stipulated in the EIA report.

2.5.1 Results of Discharged Point and Discharged Creek

As the comparison with the target value, the results of SS, TDS and total coliform exceeded the target value. As for the result of SS, results at the surface water monitoring points (SW-2 and SW-4) exceeded the target value. As for the result of TDS, results at the surface water monitoring points (SW-2, SW-4 and SW-7) exceeded the target value. The exceed results for SS and TDS maybe due to three expected reasons; i) soil erosion caused by construction of factories in Zone B and eroded soil particles may contain soluble compounds that can dissolve in water, ii) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and iii) influence by water from the downstream of monitoring points due to flow back by tidal fluctuation.

As for the result of total coliform of surface water, results at surface water monitoring points (SW-2, SW-4 and SW-7) exceeded the target value due to three expected reasons; i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect.

Since the composition of the total coliform include bacteria from natural origin, and even after total coliform do not affect human health directly, self-monitoring for E. Coli analysis was carried out to identify health impact by coliform bacteria. As for the result of E.Coli of surface water at SW-7, the result was under the reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of SW-7 but it is considered that there is no significant impact on human health.

Table 2.5-1 Results of Water Quality Monitoring at Discharged point and Discharged Creek

No.	Parameters	Unit	SW-2	SW-4	SW-7	Target Value (Reference Value for Self-Monitoring)
1	Temperature	˚C	27	26	32	≤ 35
2	pH	-	8.26	7.73	8.73	6~9
3	Suspended Solid (SS)	mg/L	82.00	80.0	20.0	50
4	Dissolved Oxygen (DO)	mg/L	6.78	6.76	6.79	-
5	$BOD_{(5)}$	mg/L	6.44	4.86	6.38	30
6	$COD_{(Cr)}$	mg/L	70	31.4	32.6	125
7	Total Coliform	MPN/ 100ml	> 160,000	2100	540	400
8	Oil and Grease	mg/L	< 3.1	< 3.1	< 3.1	10
9	Chromium	mg/L	≤ 0.002	≤ 0.002	≤ 0.002	0.5
10	Total Dissolved solids (TDS)	mg/L	4462.00	7034.00	4912.00	2000
11	Iron	mg/L	3.282	2.578	0.568	3.5
12	Mercury	mg/L	≤ 0.002	≤ 0.002	≤ 0.002	0.005
13	Escherichia Coli	MPN/100ml	-	-	6.8	(1000)* (CFU/100ml)
14	Flow Rate	m^3/s	-	0.383	-	-

Note: Red color means exceeded value than target value.

*Note: Based on the water utilization at discharged creek, the quality standard for water baths in Japan, (Ministry of Environment, 1997) is set as a reference value for self-monitoring of E. coli for surface water monitoring. However, due to limitation of capacity for analytical laboratory in Myanmar, the method to analyze the "Colony Forming Unit (CFU)" is not available in Myanmar. Therefore, the results of "Most Probable Number (MPN)" are assumed similar to CFU values and compared with reference values. Once the method to analyze the CFU will be available in Myanmar, the analytical method will be changed.

Source: Myanmar Koei International Ltd.

2.5.2 Result of Reference Tube Well

Result of water quality monitoring at reference tube well monitoring point is shown in Table 2.5-2. As the comparison with the target value, the results of total coliform and iron exceeded the target value.

As for the result of total coliform in ground water, results at GW-2 exceeded the target value. It may be possible due to expected reasons i) the poor maintenance of well which can increase the risk of bacteria and other harmful organisms ii) the well was not operated regularly and was not use for long time. However, the result of E.coli of GW-2 was under the reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of GW-2 but it is considered that there is no significant impact on human health.

As for the result of the iron, the result at the monitoring point of reference tube well (GW-2) exceeded the target value due to expected reason; 1) It may be due to the corrosion of pipes because the water is pumped through the iron pipelines buried underneath the ground. However, since it cannot reach to the conclusion of what is the reason for this result, the continuous monitoring will be necessary.

Table 2.5-2 Results of Water Quality Monitoring at Reference Tube Well

No.	Parameters	Unit	GW-2	Target Value (Reference Value for Self-Monitoring)
1	Temperature	˚C	25	≤ 35
2	pH	-	7.50	6 ~ 9
3	Suspended solid (SS)	mg/L	2.00	50
4	Dissolved oxygen (DO)	mg/L	7.38	-
5	BOD (5)	mg/L	0.15	30
6	COD (Cr)	mg/L	< 0.7	125
7	Total coliform	MPN/ 100ml	3300	400
8	Oil and grease	mg/L	< 3.1	10
9	Chromium	mg/L	≤ 0.002	0.5
10	Total Dissolved solids (TDS)	mg/L	146.00	2000
11	Iron	mg/L	5.456	3.5
12	Mercury	mg/L	≤ 0.002	0.005
13	Escherichia Coli	MPN/ 100 ml	2.0	(100)* (MPN/100ml)
14	Flow Rate	m^3/s	-	-

*Note: Based on the water utilization at monitoring point for ground water, B1(Irrigation water) of National Technical Regulation on Surface Water Quality in Vietnam (No. QCVN 08: 2008/BTNMT) is set as a reference value of self-monitoring for ground water monitoring.
Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2 (Section 2.5), the results of SS (SW-2 and SW-4), the results of TDS (SW-2, SW-4 and SW-7) and total coliform (SW-2, SW-4 and SW-7) in surface water exceeded the target value in this monitoring period for construction stage of Thilawa SEZ Zone B.

There are some possible reasons for exceeding the target values of SS (SW-2 and SW-4), TDS (SW-2, SW-4 and SW-7) and total coliform (SW-2, SW-4 and SW-7). They are by i) soil erosion caused by construction of factories in Zone B and eroded soil particles may contain soluble compounds that can dissolve in water, ii) natural origin such as natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds and small animals in and along the discharged creek and iii) wastewater from the local industrial zone outside of Thilawa SEZ and iv) delivered from surrounding area by tidal effect. Since the composition of the total coliform include bacteria from natural origin, and even after total coliform do not affect human health directly, self-monitoring for E. Coli analysis was carried out at SW-7 to identify health impact by coliform bacteria. As for the result of E.Coli of surface water at SW-7, the result was under the reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of SW-7 but it is considered that there is no significant impact on human health.

As for the result of total coliform in ground water, results at GW-2 exceeded the target value. It may be possible due to expected reasons i) the poor maintenance of well which can increase the risk of bacteria and other harmful organisms ii) the well was not operated regularly and was not use for long time. However, the result of E.coli of GW-2 was under the reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of GW-2 but it is considered that there is no significant impact on human health.

As for the result of the iron, the result at the monitoring point of reference tube well (GW-2) exceeded the target value due to expected reason; 1) It may be due to the corrosion of pipes because the water is pumped through the iron pipelines buried underneath the ground. Water from this well is only suitable for washing and bathing and drinking of this ground water without proper treatment processes is not recommended.

However, it cannot reach to the conclusion of what the reason to be exceeded the target values is, thus the continuous monitoring and yearly trend analysis will be necessary to carry out based on the rainy and dry season data.

End of the Document

APPENDIX-1 FIELD SURVEY PHOTOS

FOR DISCHARGED POINT OF THILAWA SEZ ZONE B

Surface water sampling and onsite measurement at SW-7

FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

Surface water sampling and onsite measurement at SW-2

Surface water sampling and onsite measurement at SW-4

Ground water sampling and onsite measurement at GW-2

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

APPENDIX-2 LABORATORY RESULTS

FOR DISCHARGED POINT

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motivate our planet
Doc No: GEM-LB-R004E/00

Report No. : GEM-LAB-201905068
Revision No. : 1
Report Date : 13 May, 2019
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-SW-7-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904210 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	20.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	6.38	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	32.6	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	540	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	1.3	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	3.52	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1.4	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

LAB GEM

Analysed By :
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Supervisor

Approved By :
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Managing Director

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FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201905065
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Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904207 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	82.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	6.44	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	70	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	4.5	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	14.42	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1.4	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-SW-4-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904208 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	80.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.86	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	31.4	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	2100	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	1.7	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	3.90	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-GW-2-0424
Sample No. : W-1904211
Waste Profile No. : -

Sampling Date : 24 April, 2019
Sampling By : Customer
Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	2.00	_
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	0.15	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	< 0.7	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	3300	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.1	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.669	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	9.83	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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MJTD

APPENDIX-3 LABORATORY RESULT OF ESCHERICHIA COLI (SELF-MONITORING)

FOR DISCHARGED POINT

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Report No. : GEM-LAB-201904214
Revision No. : 2
Report Date : 13 May, 2019
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-SW-7-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904193 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	6.8	1.8

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

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Report No. : GEM-LAB-201904216
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Report Date : 13 May, 2019
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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-GW-2-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904195 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	2.0	1.8

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

LAB GEM

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APPENDIX-4 LABORATORY RESULTS (SELF-MONITORING)

FOR DISCHARGED POINT

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Doc No: GEM-LB-R004E/00

Report No. : GEM-LAB-201905076
Revision No. : 1
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Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-SW-7-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904202 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
2	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.568	0.001
3	TDS	APHA 2540C (Total Dissolved Solids Dried at 180'C)	mg/l	4912.00	-

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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GEM

Analysed By :

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Hideki Yomo
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MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

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Page1of1

Report No. : GEM-LAB-201905073
Revision No. : 1
Report Date : 13 May, 2019
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-0424 — Sampling Date : 24 April, 2019
Sample No. : W-1904199 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
2	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	3.282	0.001
3	TDS	APHA 2540C (Total Dissolved Solids Dried at 180'C)	mg/l	4462.00	-

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

LAB
GEM

Analysed By :
Ni Ni Aye Lwin
Supervisor

Approved By :
Hideki Yomo
Managing Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
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Doc No: GEM-LB-R004E/00
Page1of1

Report No. : GEM-LAB-201905074
Revision No. : 1
Report Date : 13 May, 2019
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-4-0424 Sampling Date : 24 April, 2019
Sample No. : W-1904200 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
2	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	2.578	0.001
3	TDS	APHA 2540C (Total Dissolved Solids Dried at 180°C)	mg/l	7034.00	-

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

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Doc No: GEM-LB-R004E/00
Page1of1

Report No. : GEM-LAB-201905077
Revision No. : 1
Report Date : 13 May, 2019
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No, 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar.
Project Name : MJTD
Sample Description

Sample Name : MKI-GW-2-0424
Sample No. : W-1904203
Waste Profile No. : -
Sampling Date : 24 April, 2019
Sampling By : Customer
Sample Received Date : 24 April, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
2	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	5.456	0.001
3	TDS	APHA 2540C (Total Dissolved Solids Dried at 180'C)	mg/l	146.00	-

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

LAB GEM

Analysed By :

Ni Ni Aye Lwin
Supervisor

Approved By :

Hideki Yomo
Managing Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Air Quality Monitoring Report

March 2019

AIR QUALITY MONITORING

REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, air quality had been monitored from 11 March 2019 – 18 March 2019 as follows;

Table 1.2-1 Outlines of Air Quality Monitoring Plan

Monitoring Date	Monitoring Item	Parameters	Number of Point	Duration	Monitoring Methodology
From 11 March – 18 March, 2019	Air Quality	CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2	1	7 Days	On site measurement by Haz-Scanner Environmental Perimeter Air Station (EPAS)

CHAPTER 2: AIR QUALITY MONITORING

2.1 Monitoring Item

The parameters for air quality monitoring were CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS) was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast and construction of Thilawa SEZ Zone B in east, north, north-northwest, northwest and northeast respectively. The air quality monitoring is carried out above location where is near to the residential houses of Phalan village. Possible emission sources are dust emissions from construction activities and exhaust gas emissions from construction fuel-burning equipment and daily human activities in Phalan village. The location of air quality monitoring is shown in the Figure 2.2-1.

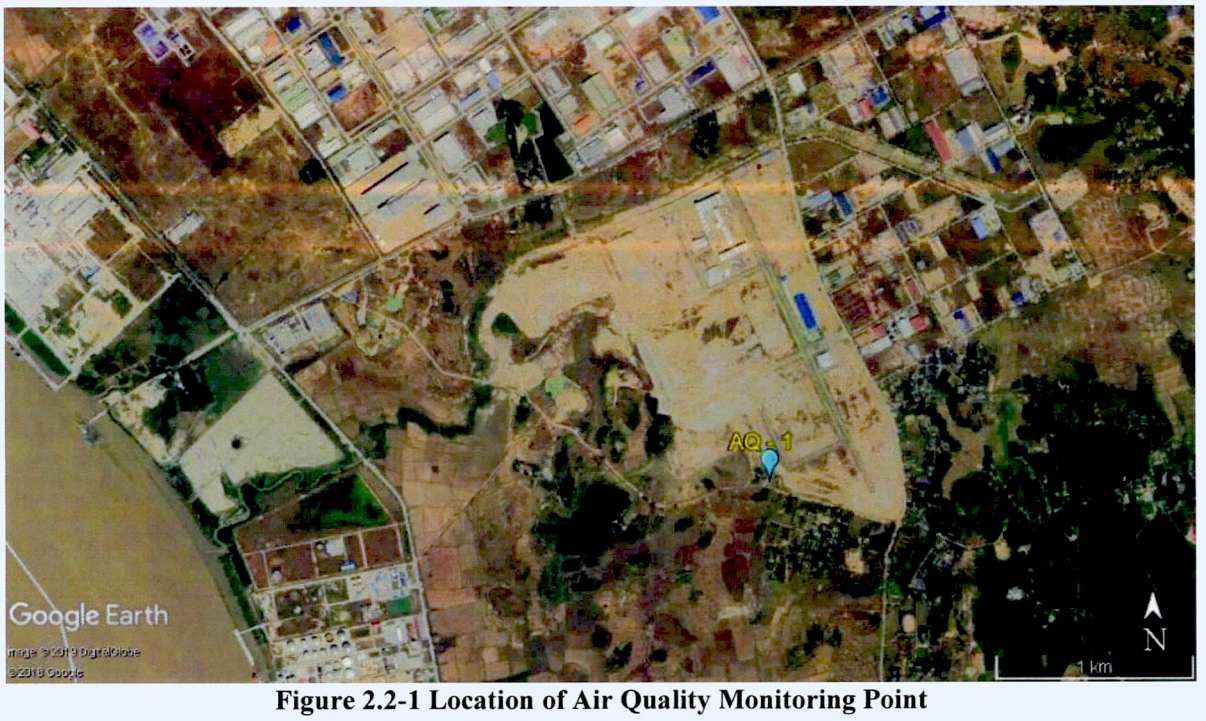

Figure 2.2-1 Location of Air Quality Monitoring Point

2.3 Monitoring Period

Air quality monitoring was conducted seven consecutive days from 11 March 2019 – 18 March 2019.

2.4 Monitoring Method

Monitoring of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 were conducted by referring to the recommendation of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS was used to collect ambient air pollutants. The EPAS measures automatically every five minutes and directly reads and records onsite for CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2. The state of air quality monitoring is shown in Figure 2.4-1.

Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 are described in Table 2.5-1. Comparing with the target value of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 prescribed in EIA report for Thilawa SEZ development project Zone B, seven days average concentration of CO and NO_2 were lower than the target value, while seven days average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results exceeded than the target value. In addition, daily average concentration of NO_2 measured results for four days, daily average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results for seven days exceeded the target value.

Table 2.5-1 Air Quality Monitoring Result (Daily Average) During Construction and Non-Construction Period

Date	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2
	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³
11 ~ 12 Mar 2019	0.195	0.101	0.105	0.174	0.245
12 ~ 13 Mar 2019	0.162	0.101	0.093	0.163	0.173
13 ~ 14 Mar 2019	0.148	0.105	0.104	0.172	0.166
14 ~ 15 Mar 2019	0.127	0.087	0.110	0.212	0.153
15 ~ 16 Mar 2019	0.153	0.079	0.103	0.158	0.200
16 ~ 17 Mar 2019	0.186	0.099	0.099	0.148	0.282
17 ~ 18 Mar 2019	0.197	0.111	0.117	0.193	0.283
7 Days Average Value	0.167	0.098	0.104	0.174	0.215
Target Value	10.26	0.1	0.025	0.050	0.02

Note: Red color mentions the exceeded value for NO_2, $PM_{2.5}$, PM_{10} and SO_2.
The target value of CO, NO_2 and SO_2 were converted from ppm units to mg/m³. The conversion equation are as follows;

1. (CO, mg/m³) = (CO, ppm) * (Molecular Weight of CO (28)) / 24.45
2. (NO_2, mg/m³) = (NO_2, ppm) * (Molecular Weight of NO_2 (46)) / 24.45
3. (SO_2, mg/m³) = (SO_2, ppm) * (Molecular Weight of SO_2 (64)) / 24.45

Construction activities of Thilawa SEZ Zone B are described in Table 2.5-2. NO_2 results, $PM_{2.5}$ results, PM_{10} results and SO_2 results during construction period are described in Table 2.5-3, Table 2.5-4, Table 2.5-5 and Table 2.5-6. During construction period, (Day 1 to Day 7) daily average results for NO_2 were lower than the target value. During construction period, seven days average value for $PM_{2.5}$, PM_{10} and SO_2 exceeded the target value and (Day 1 to Day 7) daily average results also exceeded the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Location	Construction Activities
11 March 2019	8:00-20:00	Near monastery	Pond level & slope trimming work, OBC 41 & RBC 26 backfilling work, Land grading work at BB5,6, BE9,10, Canal 5,6,7 slope trimming work, Land grading and compaction works.
12 March 2019	8:00-20:00	Near monastery	Canal 5,6,7 slope trimming, OBC & RBC backfilling and excavation work, Pipe line excavation @R 7,10,13, BE9,10 cutting, excavation works, Land grading and compaction works
13 March 2019	8:00-20:00	Near monastery	Land grading work at BE 9,10,Pipe line excavation work at Road 9,10,17, RBC, OBC backfilling & excavation work, Canal 5,6 slope trimming, walkway and buffer zone preparation works, Land grading, Levelling work and Compaction work.
14 March 2019	8:15-20:00	Near monastery	OBC, RBC excavation & backfilling work, Canal 5,6,7 and retention pond slope trimming, BL1,2 levelling work, Pipe line excavation and backfilling at road 10,13,17, BE9,10 levelling, Land grading and Levelling work.
15 March 2019	8:30-20:00	Near monastery	RBC & OBC excavation and backfilling work, backfilling and walkway preparation at road 7,10,13,15, Canal 5,6,7 and retention pond slope trimming work, Pipe line excavation, backfilling work, Land grading and Levelling work
16 March 2019	8:10-20:00	Near monastery	BH, BE plot land grading work, Canal 5,6,7 and retention pond slope trimming work, RBC & OBC excavation and backfilling work, Pipe line excvation and backfilling work, Land grading and Levelling work.
17 March 2019	8:00-20:00	Near monastery	Canal 5 and retention pond slope trimming, Road 7,14,17,19 excavation and backfilling work, BJ4, BL1,2 Land grading work, Levelling and Compaction work.
18 March 2019	8:10-20:30	Near monastery	Pipe line excavation work at road 7,14,17,19, Canal 5 & retention pond slope trimming, BH 5,6, BK plot land grading work, Land grading, Levelling work and Compaction work.

Table 2.5-3 NO_2 Results (During Construction Period)

Day	Construction Time for each day	NO_2
		mg/m^3
Day 1	8:00-20:00	0.020
Day 2	8:00-20:00	0.031
Day 3	8:00-20:00	0.025
Day 4	8:15-20:00	0.017
Day 5	8:30-20:00	0.022
Day 6	8:10-20:00	0.023
Day 7	8:00-20:00	0.029
7 days Average value		0.024
Target Value	-	0.1

Table 2.5-4 $PM_{2.5}$ Results (During Construction Period)

Day	Construction Time for each day	$PM_{2.5}$
		mg/m^3
Day 1	8:00-20:00	0.063
Day 2	8:00-20:00	0.066
Day 3	8:00-20:00	0.062
Day 4	8:15-20:00	0.063
Day 5	8:30-20:00	0.068
Day 6	8:10-20:00	0.066
Day 7	8:00-20:00	0.070
7 days Average value		0.066
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value

Table 2.5-5 PM_{10} Results (During Construction Period)

Day	Construction Time for each day	PM_{10}
		mg/m^3
Day 1	8:00-20:00	0.108
Day 2	8:00-20:00	0.104
Day 3	8:00-20:00	0.102
Day 4	8:15-20:00	0.101
Day 5	8:30-20:00	0.093
Day 6	8:10-20:00	0.104
Day 7	8:00-20:00	0.115
7 days Average value		0.104
Target Value	-	0.050

Note: Red color mentions the exceeded value than target value

Table 2.5-6 SO_2 Results (During Construction Period)

Day	Construction Time for each day	SO_2
		mg/m³
Day 1	8:00-20:00	0.349
Day 2	8:00-20:00	0.247
Day 3	8:00-20:00	0.244
Day 4	8:15-20:00	0.240
Day 5	8:30-20:00	0.280
Day 6	8:10-20:00	0.433
Day 7	8:00-20:00	0.431
7 days Average value		0.318
Target Value	-	0.020

Note: Red color mentions the exceeded value than target value

Wind direction and wind speed were measured at AQ-1. Hourly average values of measured wind direction and wind speed data are described in Appendix-1. Status of air quality monitoring point and wind direction are described in Figure 2.5-1. Depending on the wind direction, West-Northwest (WNW), Northwest (NW), North-Northwest (NNW), North (N), North-Northeast (NNE), Northeast (NE), East-Northeast (ENE) and East (E) directions are assumed come from the construction site of Zone B.

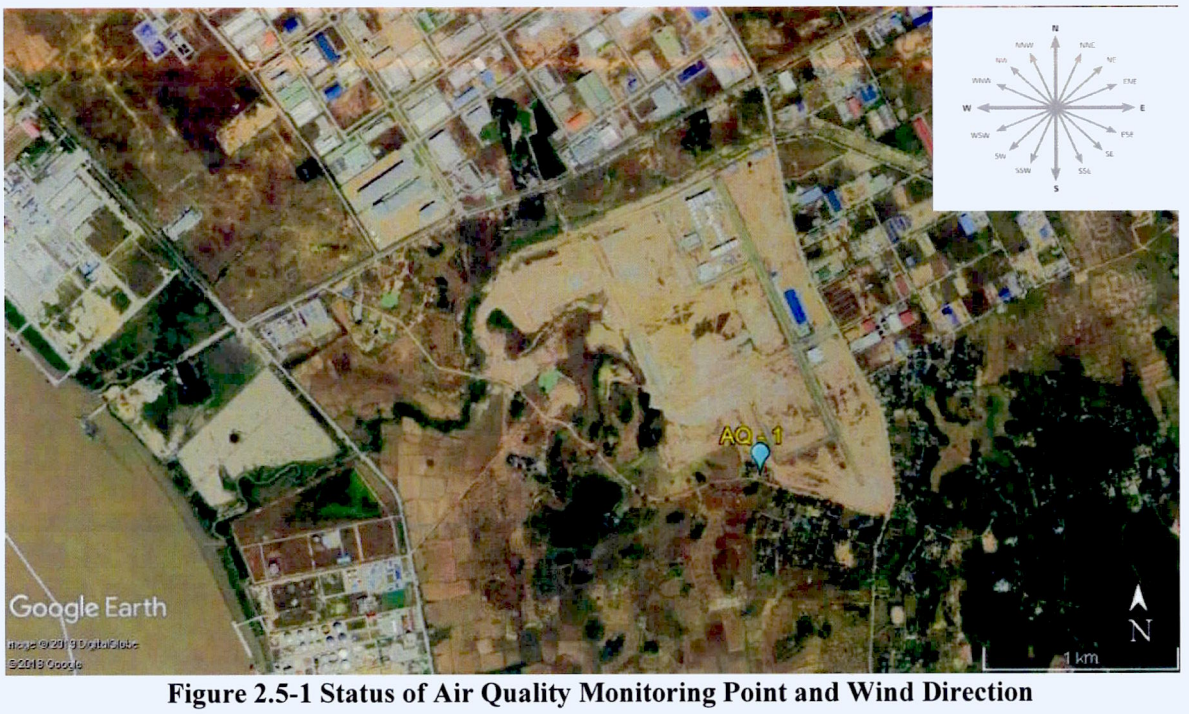

Figure 2.5-1 Status of Air Quality Monitoring Point and Wind Direction

Remark: **N** *North* **NNE** *North-Northeast* **NE** *Northeast* **ENE** *East-Northeast* **E** *East* **ESE** *East-Southeast* **SE** *Southeast* **SSE** *South-Southeast* **S** *South* **SSW** *South-Southwest* **SW** *Southwest* **WSW** *West-Southwest* **W** *West* **WNW** *West-Northwest* **NW** *Northwest* **NNW** *North-Northwest*

Overall summary of total exceeded hours for Day 1 to Day 7 during construction and non-construction time for $PM_{2.5}$, PM_{10} and SO_2 are shown in Table 2.5-7, Table 2.5-8 and Table 2.5-9. The summary of wind direction at AQ-1 is shown in Table 2.5-10.

Based on the summary table of total exceeded hours for $PM_{2.5}$, the total exceeded hours for seven days during construction and non-construction time were 141 hours but exceeded hours for construction time was 57 hours. After detailed analyzed the $PM_{2.5}$ exceeded time according to the wind direction during construction period, 7 hours exceeded are come from the construction site of Zone B and 50 hours exceeded are come from other sides of Zone B.

Based on the summary table of total exceeded hours for PM_{10}, the total exceeded hours for seven days during construction and non-construction were 164 hours but exceeded hours for construction time was 80 hours. After detailed analyzed the PM_{10} exceeded time according to the wind direction during construction period, 11 hours exceeded are come from the construction site of Zone B and 69 hours exceeded are come from other sides of Zone B.

Based on the summary table of total exceeded hours for SO_2, the total exceeded hours for seven days during construction and non-construction were 168 hours but exceeded hours for construction time was 84 hours. After detailed analyzed the SO_2 exceeded time according to the wind direction during construction period, 12 hours exceeded are come from the construction site of Zone B and 72 hours exceeded are come from other sides of Zone B.

According to the summary of wind direction at AQ-1, 82.1% come from outside of Zone B and 17.9 % come from inside of Zone B.

Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved land area from outside of Zone B, transportation in and around the monitoring area and construction activities of Zone B.

Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B.

Possible emission sources for NO_2 are affected from motor vehicles exhaust from nearby roads.

Table 2.5-7 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for $PM_{2.5}$

$PM_{2.5}$								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	8:00-20:00	18	6	12	0	12	1	5
Day-2	8:00-20:00	20	8	12	3	9	2	6
Day-3	8:00-20:00	20	8	12	2	10	1	7
Day-4	8:15-20:00	21	9	12	0	12	0	9
Day-5	8:30-20:00	21	9	12	0	12	1	8
Day-6	8:10-20:00	20	8	12	2	10	1	7
Day-7	8:00-20:00	21	9	12	0	12	1	8
Total		141	57	84	7	77	7	50

Note: Red color is referred to the construction period exceeded hours and construction period (wind from Zone B).

Table 2.5-8 Summary of Total Exceeded Hours for Day 1 to Day 7 During Construction and Non-Construction Period for PM_{10}

PM_{10}								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	8:00-20:00	24	12	12	0	12	2	10
Day-2	8:00-20:00	24	12	12	3	9	3	9
Day-3	8:00-20:00	24	12	12	2	10	2	10
Day-4	8:15-20:00	24	12	12	0	12	0	12
Day-5	8:30-20:00	21	9	12	0	12	1	8
Day-6	8:10-20:00	23	11	12	2	10	2	9
Day-7	8:00-20:00	24	12	12	0	12	1	11
Total		164	80	84	7	77	11	69

Note: Red color is referred to the construction period exceeded hours and construction period (wind from Zone B).

Table 2.5-9 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for SO_2

SO_2								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	8:00-20:00	24	12	12	0	12	2	10
Day-2	8:00-20:00	24	12	12	3	9	3	9
Day-3	8:00-20:00	24	12	12	2	10	2	10
Day-4	8:15-20:00	24	12	12	0	12	0	12
Day-5	8:30-20:00	24	12	12	0	12	1	11
Day-6	8:10-20:00	24	12	12	2	10	3	9
Day-7	8:00-20:00	24	12	12	0	12	1	11
Total		168	84	84	7	77	12	72

Note: Red color is referred to the construction period exceeded hours and construction period (wind from Zone B).

Table 2.5-10 Summary of Wind Direction at AQ-1

Wind Direction	All Day	Day Time	Night Time	Inside/Outside Zone B	
N	1.1%	1.5%	0.8%	15.0%	Inside Zone B
NNE	2.0%	2.1%	1.9%		
NE	1.9%	2.3%	1.5%		
ENE	5.1%	4.7%	5.5%		
E	5.0%	4.1%	5.9%		
ESE	5.4%	3.5%	7.3%	82.1%	Outside Zone B
SE	12.8%	6.4%	19.2%		
SSE	12.4%	6.3%	18.5%		
S	5.6%	4.6%	6.6%		
SSW	10.4%	11.4%	9.3%		
SW	25.3%	35.0%	15.6%		
WSW	7.1%	8.8%	5.4%		
W	1.8%	2.8%	0.9%		
WNW	1.3%	1.9%	0.7%		
NW	1.1%	2.0%	0.3%	2.8%	Inside Zone B
NNW	1.7%	2.7%	0.7%		

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The result of air quality of CO during seven days monitoring did not exceed the target value, thus there are no impacts on the surrounding environments. On the other hand, results of $PM_{2.5}$, PM_{10} and SO_2 level measured for seven days consecutive measurement in this monitoring period are higher than the target value and NO_2 levels measured for four days are slightly higher than the target value. During construction period, (Day 1 to Day 7) daily average results were lower than the target value.

During the seven days monitoring period, 141 hours results were exceeded for $PM_{2.5}$. According to wind direction of Zone B during the construction period, total 57 exceeded hours are during construction period, 7 exceeded hours are come from constriction site of Zone B and 50 exceeded hours are come from outside of Zone B. During the seven days monitoring period, 164 hours results were exceeded for PM_{10}. According to wind direction of Zone B during the construction period, total 80 exceeded hours are during construction period, 11 exceeded hours are come from constriction site of Zone B and 69 exceeded hours are come from outside of Zone B. Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved land area from outside of Zone B, transportation in and around the monitoring area and construction activities of Zone B. According to US Environmental Protection Agency (EPA) and WHO' health effect of particulate matter, there is no evidence of safe level of exposure or a threshold below which no adverse health effects occur. Exposure to $PM_{2.5}$ and PM_{10} reduces the life expectancy of the population of the Region by about 8.6 months on average. Short term (hours, days) exposure to $PM_{2.5}$ and PM_{10} can aggravate lung disease, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. In people with heart disease, short term exposures have been linked to heart attacks and arrhythmias. However, healthy children and adults have not been reported to suffer serious effects from short term exposures. Long term exposures (months, years) have been associated with problems such as reduced lung function and the development of chronic bronchitis and even premature death.

During the seven days monitoring period, 168 hours results were exceeded for SO_2. According to wind direction of Zone B during the construction period, total 84 exceeded hours are during construction period, 12 exceeded hours are come from constriction site of Zone B and 72 exceeded hours are come from outside of Zone B. Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B. In the public health statement SO_2 reported by ATSDR (Agency for Toxic Substances and Disease Registry) in US, 100 ppm (261.8 mg/m^3) SO_2 is considered immediately dangerous to life and health (short term). Lung function changes observed when 0.4 to 3 ppm (1.05mg/m^3 to 7.85 mg/m^3) exposure for 20 years or more (long term).

According to the summary of wind direction at AQ-1, 82.1 % come from outside of Zone B and 17.9 % come from inside of Zone B.

As for future subject for air quality monitoring in Zone B, the following action may be taken to achieve the target level:

1) To spray the water during construction period.
2) To control the speed limit of all machinery & vehicle (25km/hr) on site to avoid excessive dust creation and to minimize air pollution by the exhaust fumes.
3) To conduct the proper operation (stop idling while no operation).
4) To implement the regular maintenance of machine used for construction activities.
5) To give awareness training to workers on machinery.
6) To check and maintain the generator regularly.

The continuous monitoring will be necessary to grasp the environmental conditions in construction stage of Thilawa SEZ Zone B. The mitigation measures for environmental management will be considered in collected periodical environmental data and has to be reviewed in future.

APPENDIX-1 HOURLY AIR RESULTS

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
11 Mar 2019	11:00 ~ 12:00	0.000	0.004	0.021	0.086	0.445	1.82	128.50	SE
11 Mar 2019	12:00 ~ 13:00	0.001	0.004	0.021	0.115	0.433	2.38	145.83	SE
11 Mar 2019	13:00 ~ 14:00	0.000	0.004	0.015	0.087	0.513	3.62	203.17	SSW
11 Mar 2019	14:00 ~ 15:00	0.000	0.004	0.004	0.070	0.467	3.53	171.42	S
11 Mar 2019	15:00 ~ 16:00	0.000	0.004	0.024	0.092	0.524	3.92	134.25	SE
11 Mar 2019	16:00 ~ 17:00	0.007	0.004	0.164	0.152	0.468	4.22	133.58	SE
11 Mar 2019	17:00 ~ 18:00	0.068	0.006	0.137	0.128	0.398	2.55	126.25	SE
11 Mar 2019	18:00 ~ 19:00	0.236	0.004	0.116	0.129	0.355	1.13	144.00	SE
11 Mar 2019	19:00 ~ 20:00	0.246	0.036	0.104	0.125	0.343	0.81	165.08	SSE
11 Mar 2019	20:00 ~ 21:00	0.303	0.094	0.108	0.135	0.291	0.26	193.33	SSW
11 Mar 2019	21:00 ~ 22:00	0.292	0.143	0.121	0.158	0.236	3.49	223.58	SW
11 Mar 2019	22:00 ~ 23:00	0.229	0.178	0.103	0.143	0.204	4.02	233.17	SW
11 Mar 2019	23:00 ~ 0:00	0.226	0.184	0.093	0.129	0.142	3.85	230.92	SW
12 Mar 2019	0:00 ~ 1:00	0.224	0.194	0.103	0.144	0.111	3.68	231.08	SW
12 Mar 2019	1:00 ~ 2:00	0.234	0.192	0.128	0.175	0.086	1.09	224.58	SW
12 Mar 2019	2:00 ~ 3:00	0.203	0.190	0.126	0.177	0.075	1.68	217.92	SW
12 Mar 2019	3:00 ~ 4:00	0.196	0.192	0.140	0.216	0.059	0.75	209.92	SSW
12 Mar 2019	4:00 ~ 5:00	0.204	0.190	0.156	0.305	0.057	0.00	198.00	SSW
12 Mar 2019	5:00 ~ 6:00	0.280	0.194	0.189	0.411	0.066	0.00	198.00	SSW
12 Mar 2019	6:00 ~ 7:00	0.508	0.209	0.296	0.592	0.141	0.00	175.67	S
12 Mar 2019	7:00 ~ 8:00	0.657	0.222	0.199	0.293	0.226	0.00	149.33	SSE
12 Mar 2019	8:00 ~ 9:00	0.202	0.147	0.085	0.131	0.098	0.33	135.25	SE
12 Mar 2019	9:00 ~ 10:00	0.204	0.021	0.043	0.093	0.062	1.48	70.58	ENE
12 Mar 2019	10:00 ~ 11:00	0.154	0.004	0.023	0.087	0.084	2.87	78.67	ENE

Max	0.657	0.222	0.296	0.592	0.524
Avg	0.195	0.101	0.105	0.174	0.245
Min	0.000	0.004	0.004	0.070	0.057

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
12 Mar 2019	11:00 ~ 12:00	0.068	0.004	0.020	0.070	0.146	2.38	130.58	SE
12 Mar 2019	12:00 ~ 13:00	0.020	0.004	0.065	0.128	0.321	5.52	177.17	S
12 Mar 2019	13:00 ~ 14:00	0.002	0.004	0.008	0.078	0.244	5.02	139.25	SE
12 Mar 2019	14:00 ~ 15:00	0.080	0.004	0.025	0.086	0.341	5.38	136.17	SE
12 Mar 2019	15:00 ~ 16:00	0.031	0.004	0.054	0.095	0.413	5.96	132.00	SE
12 Mar 2019	16:00 ~ 17:00	0.031	0.004	0.107	0.121	0.361	5.63	125.08	SE
12 Mar 2019	17:00 ~ 18:00	0.089	0.004	0.149	0.135	0.256	3.30	142.75	SE
12 Mar 2019	18:00 ~ 19:00	0.177	0.006	0.117	0.125	0.267	1.82	135.42	SE
12 Mar 2019	19:00 ~ 20:00	0.221	0.056	0.087	0.096	0.274	1.20	162.92	SSE
12 Mar 2019	20:00 ~ 21:00	0.214	0.098	0.077	0.092	0.190	0.28	186.33	S
12 Mar 2019	21:00 ~ 22:00	0.252	0.131	0.077	0.102	0.159	0.31	207.83	SSW
12 Mar 2019	22:00 ~ 23:00	0.209	0.152	0.077	0.108	0.134	1.44	217.75	SW
12 Mar 2019	23:00 ~ 0:00	0.156	0.156	0.083	0.117	0.099	3.60	236.58	WSW
13 Mar 2019	0:00 ~ 1:00	0.174	0.175	0.084	0.123	0.082	1.52	236.50	WSW
13 Mar 2019	1:00 ~ 2:00	0.159	0.190	0.097	0.155	0.079	0.44	223.17	SW
13 Mar 2019	2:00 ~ 3:00	0.148	0.201	0.116	0.214	0.041	0.00	216.00	SW
13 Mar 2019	3:00 ~ 4:00	0.145	0.197	0.142	0.303	0.030	0.01	216.00	SW
13 Mar 2019	4:00 ~ 5:00	0.168	0.191	0.140	0.303	0.029	0.01	175.25	S
13 Mar 2019	5:00 ~ 6:00	0.184	0.194	0.156	0.413	0.035	0.05	75.00	ENE
13 Mar 2019	6:00 ~ 7:00	0.422	0.185	0.186	0.435	0.090	0.00	61.00	ENE
13 Mar 2019	7:00 ~ 8:00	0.476	0.212	0.202	0.306	0.226	0.04	74.25	ENE
13 Mar 2019	8:00 ~ 9:00	0.174	0.191	0.118	0.177	0.143	0.98	90.25	E
13 Mar 2019	9:00 ~ 10:00	0.135	0.084	0.027	0.078	0.101	3.92	77.83	ENE
13 Mar 2019	10:00 ~ 11:00	0.153	0.005	0.011	0.053	0.100	3.79	77.50	ENE

Max	0.476	0.212	0.202	0.435	0.413
Avg	0.162	0.101	0.093	0.163	0.173
Min	0.002	0.004	0.008	0.053	0.029

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
13 Mar 2019	11:00 ~ 12:00	0.136	0.004	0.016	0.064	0.166	2.73	116.58	ESE
13 Mar 2019	12:00 ~ 13:00	0.074	0.004	0.026	0.083	0.295	4.43	164.25	SSE
13 Mar 2019	13:00 ~ 14:00	0.071	0.004	0.005	0.083	0.248	4.25	182.58	S
13 Mar 2019	14:00 ~ 15:00	0.086	0.004	0.004	0.051	0.314	3.39	150.50	SSE
13 Mar 2019	15:00 ~ 16:00	0.071	0.004	0.067	0.092	0.403	4.67	137.17	SE
13 Mar 2019	16:00 ~ 17:00	0.018	0.004	0.123	0.126	0.377	5.27	127.33	SE
13 Mar 2019	17:00 ~ 18:00	0.123	0.004	0.119	0.126	0.322	2.86	151.08	SSE
13 Mar 2019	18:00 ~ 19:00	0.204	0.004	0.143	0.156	0.259	2.22	159.08	SSE
13 Mar 2019	19:00 ~ 20:00	0.221	0.064	0.108	0.137	0.244	0.95	189.92	S
13 Mar 2019	20:00 ~ 21:00	0.143	0.109	0.098	0.132	0.189	0.03	191.33	SSW
13 Mar 2019	21:00 ~ 22:00	0.253	0.153	0.117	0.174	0.159	0.03	195.42	SSW
13 Mar 2019	22:00 ~ 23:00	0.152	0.174	0.103	0.150	0.127	2.15	228.92	SW
13 Mar 2019	23:00 ~ 0:00	0.147	0.180	0.103	0.145	0.087	3.23	228.33	SW
14 Mar 2019	0:00 ~ 1:00	0.178	0.182	0.123	0.175	0.078	2.38	229.08	SW
14 Mar 2019	1:00 ~ 2:00	0.157	0.182	0.136	0.206	0.062	0.63	232.75	SW
14 Mar 2019	2:00 ~ 3:00	0.167	0.211	0.159	0.266	0.048	0.29	234.50	SW
14 Mar 2019	3:00 ~ 4:00	0.148	0.212	0.158	0.289	0.042	0.00	223.00	SW
14 Mar 2019	4:00 ~ 5:00	0.170	0.201	0.195	0.371	0.039	0.00	223.00	SW
14 Mar 2019	5:00 ~ 6:00	0.154	0.203	0.249	0.475	0.056	0.98	132.00	SE
14 Mar 2019	6:00 ~ 7:00	0.173	0.202	0.198	0.337	0.063	0.63	92.92	E
14 Mar 2019	7:00 ~ 8:00	0.220	0.207	0.119	0.184	0.108	0.73	95.92	E
14 Mar 2019	8:00 ~ 9:00	0.178	0.165	0.084	0.139	0.108	2.28	107.50	ESE
14 Mar 2019	9:00 ~ 10:00	0.176	0.032	0.039	0.101	0.082	3.28	89.50	E
14 Mar 2019	10:00 ~ 11:00	0.142	0.004	0.016	0.065	0.105	3.01	89.17	E

Max	0.253	0.212	0.249	0.475	0.403
Avg	0.148	0.105	0.104	0.172	0.166
Min	0.018	0.004	0.004	0.051	0.039

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
14 Mar 2019	11:00 ~ 12:00	0.087	0.004	0.038	0.071	0.243	4.55	155.33	SSE
14 Mar 2019	12:00 ~ 13:00	0.089	0.004	0.037	0.099	0.310	4.79	152.33	SSE
14 Mar 2019	13:00 ~ 14:00	0.091	0.004	0.013	0.095	0.316	4.43	149.25	SSE
14 Mar 2019	14:00 ~ 15:00	0.068	0.004	0.010	0.069	0.349	3.82	134.75	SE
14 Mar 2019	15:00 ~ 16:00	0.052	0.004	0.068	0.090	0.351	4.66	133.83	SE
14 Mar 2019	16:00 ~ 17:00	0.028	0.004	0.121	0.132	0.301	4.22	131.33	SE
14 Mar 2019	17:00 ~ 18:00	0.120	0.004	0.109	0.114	0.274	2.87	134.92	SE
14 Mar 2019	18:00 ~ 19:00	0.141	0.004	0.121	0.122	0.223	1.56	137.92	SE
14 Mar 2019	19:00 ~ 20:00	0.177	0.031	0.086	0.110	0.185	0.43	176.83	S
14 Mar 2019	20:00 ~ 21:00	0.201	0.074	0.114	0.147	0.149	0.00	204.00	SSW
14 Mar 2019	21:00 ~ 22:00	0.286	0.122	0.123	0.177	0.138	0.00	204.00	SSW
14 Mar 2019	22:00 ~ 23:00	0.127	0.142	0.128	0.194	0.104	0.00	204.00	SSW
14 Mar 2019	23:00 ~ 0:00	0.065	0.148	0.144	0.241	0.060	0.00	204.00	SSW
15 Mar 2019	0:00 ~ 1:00	0.108	0.162	0.177	0.373	0.052	0.30	211.75	SSW
15 Mar 2019	1:00 ~ 2:00	0.140	0.176	0.169	0.322	0.061	1.19	229.25	SW
15 Mar 2019	2:00 ~ 3:00	0.094	0.174	0.187	0.372	0.036	0.30	219.50	SW
15 Mar 2019	3:00 ~ 4:00	0.116	0.173	0.184	0.658	0.024	0.17	196.17	SSW
15 Mar 2019	4:00 ~ 5:00	0.105	0.179	0.168	0.489	0.037	1.34	228.58	SW
15 Mar 2019	5:00 ~ 6:00	0.144	0.178	0.188	0.409	0.031	0.23	260.67	W
15 Mar 2019	6:00 ~ 7:00	0.209	0.182	0.174	0.294	0.037	0.02	176.75	S
15 Mar 2019	7:00 ~ 8:00	0.194	0.169	0.129	0.203	0.053	0.03	124.17	SE
15 Mar 2019	8:00 ~ 9:00	0.112	0.120	0.093	0.149	0.061	0.31	128.33	SE
15 Mar 2019	9:00 ~ 10:00	0.149	0.019	0.048	0.090	0.103	0.75	152.92	SSE
15 Mar 2019	10:00 ~ 11:00	0.146	0.004	0.014	0.073	0.167	1.13	145.17	SE

Max	0.286	0.182	0.188	0.658	0.351
Avg	0.127	0.087	0.110	0.212	0.153
Min	0.028	0.004	0.010	0.069	0.024

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
15 Mar 2019	11:00 ~ 12:00	0.071	0.004	0.057	0.086	0.192	2.10	207.50	SSW
15 Mar 2019	12:00 ~ 13:00	0.004	0.004	0.029	0.089	0.114	2.75	221.50	SW
15 Mar 2019	13:00 ~ 14:00	0.000	0.004	0.002	0.044	0.300	2.59	243.58	WSW
15 Mar 2019	14:00 ~ 15:00	0.015	0.004	0.007	0.011	0.400	2.48	234.00	SW
15 Mar 2019	15:00 ~ 16:00	0.000	0.004	0.011	0.019	0.525	2.54	223.00	SW
15 Mar 2019	16:00 ~ 17:00	0.008	0.004	0.130	0.122	0.528	4.63	134.33	SE
15 Mar 2019	17:00 ~ 18:00	0.023	0.004	0.130	0.104	0.287	2.83	153.75	SSE
15 Mar 2019	18:00 ~ 19:00	0.176	0.004	0.099	0.107	0.224	1.28	152.00	SSE
15 Mar 2019	19:00 ~ 20:00	0.323	0.004	0.141	0.144	0.285	0.26	177.17	S
15 Mar 2019	20:00 ~ 21:00	0.284	0.023	0.120	0.141	0.263	0.21	148.42	SSE
15 Mar 2019	21:00 ~ 22:00	0.224	0.056	0.092	0.118	0.197	0.14	188.50	S
15 Mar 2019	22:00 ~ 23:00	0.187	0.083	0.087	0.110	0.145	1.01	194.50	SSW
15 Mar 2019	23:00 ~ 0:00	0.177	0.124	0.088	0.112	0.121	1.93	234.58	SW
16 Mar 2019	0:00 ~ 1:00	0.137	0.151	0.093	0.125	0.102	0.53	225.42	SW
16 Mar 2019	1:00 ~ 2:00	0.136	0.152	0.112	0.176	0.072	0.07	203.75	SSW
16 Mar 2019	2:00 ~ 3:00	0.137	0.156	0.138	0.226	0.050	0.00	166.00	SSE
16 Mar 2019	3:00 ~ 4:00	0.157	0.162	0.150	0.277	0.054	0.03	166.00	SSE
16 Mar 2019	4:00 ~ 5:00	0.154	0.165	0.146	0.282	0.050	0.00	166.00	SSE
16 Mar 2019	5:00 ~ 6:00	0.196	0.173	0.250	0.454	0.071	0.00	166.00	SSE
16 Mar 2019	6:00 ~ 7:00	0.185	0.194	0.186	0.382	0.129	0.00	166.00	SSE
16 Mar 2019	7:00 ~ 8:00	0.448	0.201	0.181	0.273	0.182	0.07	105.58	ESE
16 Mar 2019	8:00 ~ 9:00	0.163	0.166	0.105	0.159	0.133	0.37	88.67	E
16 Mar 2019	9:00 ~ 10:00	0.224	0.063	0.075	0.132	0.158	0.75	212.33	SSW
16 Mar 2019	10:00 ~ 11:00	0.252	0.004	0.032	0.095	0.209	0.88	277.83	W

Max	0.448	0.201	0.250	0.454	0.528
Avg	0.153	0.079	0.103	0.158	0.200
Min	0.000	0.004	0.002	0.011	0.050

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
16 Mar 2019	11:00 ~ 12:00	0.197	0.004	0.044	0.109	0.328	1.69	212.75	SSW
16 Mar 2019	12:00 ~ 13:00	0.117	0.004	0.017	0.082	0.378	1.88	260.25	W
16 Mar 2019	13:00 ~ 14:00	0.097	0.004	0.003	0.062	0.497	1.98	287.83	WNW
16 Mar 2019	14:00 ~ 15:00	0.120	0.004	0.005	0.038	0.637	1.44	286.67	WNW
16 Mar 2019	15:00 ~ 16:00	0.109	0.004	0.049	0.060	0.724	1.84	239.08	WSW
16 Mar 2019	16:00 ~ 17:00	0.134	0.004	0.137	0.133	0.727	2.76	190.75	S
16 Mar 2019	17:00 ~ 18:00	0.226	0.004	0.145	0.135	0.624	2.26	131.58	SE
16 Mar 2019	18:00 ~ 19:00	0.336	0.004	0.131	0.142	0.433	1.65	152.67	SSE
16 Mar 2019	19:00 ~ 20:00	0.279	0.010	0.104	0.150	0.298	0.68	142.25	SE
16 Mar 2019	20:00 ~ 21:00	0.279	0.074	0.118	0.114	0.266	0.19	144.58	SE
16 Mar 2019	21:00 ~ 22:00	0.251	0.128	0.105	0.121	0.222	0.12	171.17	S
16 Mar 2019	22:00 ~ 23:00	0.109	0.157	0.084	0.114	0.161	1.90	221.58	SW
16 Mar 2019	23:00 ~ 0:00	0.108	0.175	0.092	0.124	0.131	3.85	225.58	SW
17 Mar 2019	0:00 ~ 1:00	0.193	0.187	0.106	0.151	0.123	1.20	221.17	SW
17 Mar 2019	1:00 ~ 2:00	0.185	0.193	0.121	0.173	0.112	2.51	233.75	SW
17 Mar 2019	2:00 ~ 3:00	0.171	0.195	0.143	0.206	0.110	3.33	230.75	SW
17 Mar 2019	3:00 ~ 4:00	0.180	0.201	0.155	0.228	0.096	0.81	224.08	SW
17 Mar 2019	4:00 ~ 5:00	0.160	0.192	0.155	0.248	0.061	0.12	241.33	WSW
17 Mar 2019	5:00 ~ 6:00	0.198	0.188	0.166	0.279	0.070	0.00	246.17	WSW
17 Mar 2019	6:00 ~ 7:00	0.186	0.202	0.186	0.296	0.091	0.21	81.17	E
17 Mar 2019	7:00 ~ 8:00	0.217	0.207	0.162	0.239	0.129	0.24	43.17	NE
17 Mar 2019	8:00 ~ 9:00	0.191	0.184	0.093	0.158	0.137	0.43	58.58	ENE
17 Mar 2019	9:00 ~ 10:00	0.175	0.053	0.049	0.115	0.153	0.95	156.83	SSE
17 Mar 2019	10:00 ~ 11:00	0.244	0.004	0.017	0.069	0.257	1.04	262.25	W

Max	0.336	0.207	0.186	0.296	0.727
Avg	0.186	0.099	0.099	0.148	0.282
Min	0.097	0.004	0.003	0.038	0.061

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED M.J.T.D.

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
17 Mar 2019	11:00 ~ 12:00	0.257	0.004	0.039	0.103	0.406	1.34	192.92	SSW
17 Mar 2019	12:00 ~ 13:00	0.230	0.004	0.015	0.103	0.530	1.63	218.33	SW
17 Mar 2019	13:00 ~ 14:00	0.186	0.004	0.015	0.072	0.613	2.65	237.33	WSW
17 Mar 2019	14:00 ~ 15:00	0.167	0.004	0.026	0.071	0.651	3.44	236.50	WSW
17 Mar 2019	15:00 ~ 16:00	0.203	0.004	0.092	0.137	0.741	3.83	174.25	S
17 Mar 2019	16:00 ~ 17:00	0.204	0.004	0.142	0.166	0.575	3.18	174.25	S
17 Mar 2019	17:00 ~ 18:00	0.272	0.004	0.156	0.157	0.439	2.73	134.25	SE
17 Mar 2019	18:00 ~ 19:00	0.280	0.005	0.123	0.139	0.363	1.52	137.67	SE
17 Mar 2019	19:00 ~ 20:00	0.204	0.042	0.106	0.156	0.291	0.93	172.08	S
17 Mar 2019	20:00 ~ 21:00	0.217	0.111	0.123	0.149	0.249	1.43	227.83	SW
17 Mar 2019	21:00 ~ 22:00	0.219	0.158	0.141	0.155	0.223	1.95	231.33	SW
17 Mar 2019	22:00 ~ 23:00	0.162	0.186	0.119	0.151	0.163	4.11	229.75	SW
17 Mar 2019	23:00 ~ 0:00	0.185	0.187	0.116	0.160	0.134	3.42	225.25	SW
18 Mar 2019	0:00 ~ 1:00	0.157	0.188	0.113	0.155	0.127	3.47	226.58	SW
18 Mar 2019	1:00 ~ 2:00	0.164	0.207	0.148	0.232	0.118	1.71	230.08	SW
18 Mar 2019	2:00 ~ 3:00	0.168	0.214	0.191	0.315	0.113	1.25	224.33	SW
18 Mar 2019	3:00 ~ 4:00	0.164	0.216	0.223	0.418	0.100	0.52	218.17	SW
18 Mar 2019	4:00 ~ 5:00	0.151	0.219	0.250	0.497	0.087	0.91	227.25	SW
18 Mar 2019	5:00 ~ 6:00	0.242	0.207	0.229	0.465	0.097	0.00	222.00	SW
18 Mar 2019	6:00 ~ 7:00	0.237	0.209	0.198	0.384	0.100	0.07	222.00	SW
18 Mar 2019	7:00 ~ 8:00	0.174	0.217	0.103	0.181	0.114	0.44	220.50	SW
18 Mar 2019	8:00 ~ 9:00	0.103	0.192	0.074	0.121	0.126	0.23	269.75	W
18 Mar 2019	9:00 ~ 10:00	0.207	0.079	0.044	0.093	0.178	0.86	83.33	E
18 Mar 2019	10:00 ~ 11:00	0.180	0.004	0.014	0.057	0.254	2.53	121.83	ESE

Max	0.280	0.219	0.250	0.497	0.741
Avg	0.197	0.111	0.117	0.193	0.283
Min	0.103	0.004	0.014	0.057	0.087

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Noise and Vibration Monitoring Report

March 2019

NOISE AND VIBRATION

MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd., (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, noise and vibration levels had been monitored from 12 March 2019 – 14 March 2019 as follows;

Table 1.2-1 Outlines of Noise and Vibration Level Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
From 12–13 March 2019	Noise Level	L_{Aeq} (dB)	1 (NV-1)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 13–14 March 2019	Noise Level	L_{Aeq} (dB)	1 (NV-2)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 12–13 March 2019	Vibration Level	L_{v10} (dB)	1 (NV-1)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"
From 13–14 March 2019	Vibration Level	L_{v10} (dB)	1 (NV-2)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"

CHAPTER 2: NOISE AND VIBRATION LEVEL MONITORING

2.1 Monitoring Item

The noise and vibration level monitoring items are shown in Table 2.1-1.

Table 2.1-1 Monitoring Parameters for Noise and Vibration Level

No.	Item	Parameter
1	Noise	A-weighed loudness equivalent (L_{Aeq})
2	Vibration	Vibration level, vertical, percentile (L_{V10})

2.2 Monitoring Location

Noise and vibration levels were measured at the northeast corner of the Thilawa SEZ Zone B, monitoring point (NV-1); N: 16°40'18.22", E: 96°17'18.18" for traffic noise concerned and at the south of the Thilawa SEZ Zone B, monitoring point (NV-2); N: 16°39'24.90", E: 96°17'16.70", inside the monastery compound of Phalan village. The location of the noise and vibration monitoring points are shown in Figure 2.2-1.

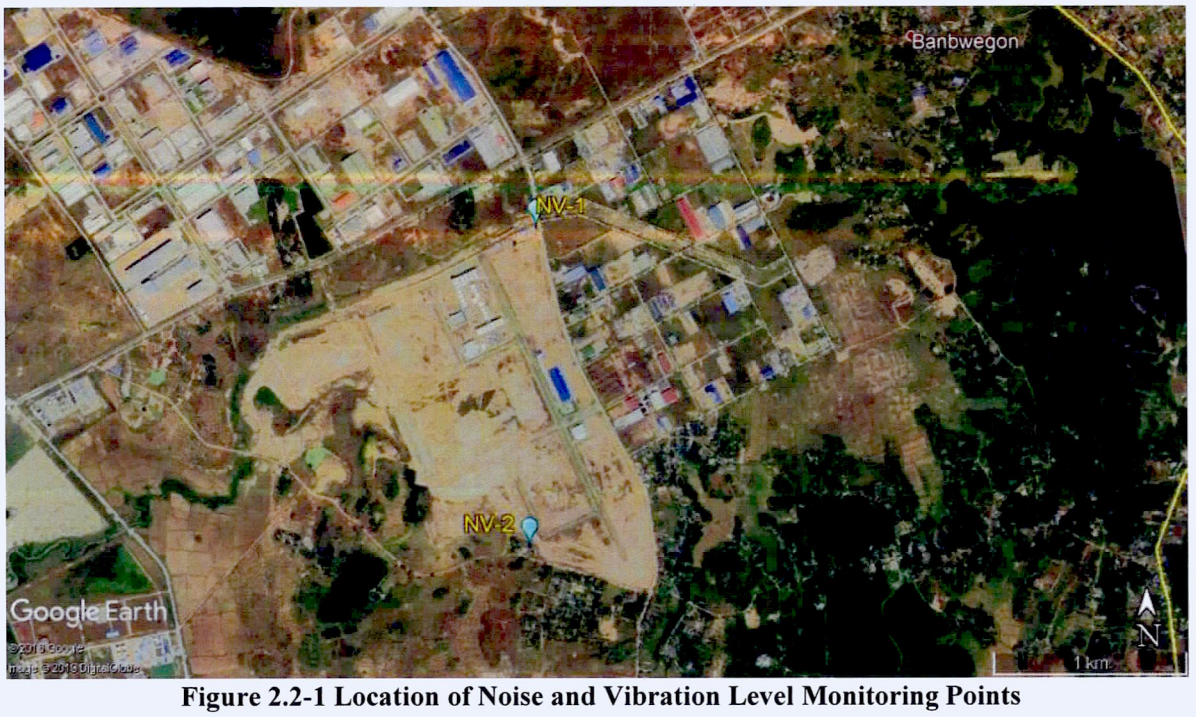

Figure 2.2-1 Location of Noise and Vibration Level Monitoring Points

NV-1

NV-1 is located in front of temporary gate of construction site of Thilawa SEZ Zone B and next to Thilawa Development road. The surrounding area are Zone A in the northwest, local industrial zone in the east respectively. Possible sources of noise and vibration is generated from construction activities and road traffic.

NV-2

NV-2 is located at the south of the Thilawa SEZ Zone B, inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local industrial zone in northeast respectively. Possible sources of noise and vibration is generated from construction activities from Zone B and daily human activities from nearby Phalan village.

2.3 Monitoring Method

Noise level was measured by "Rion NL-42 sound level meter" and automatically records every 10 minutes in a memory card. The vibration level meter, VM-53A (Rion Co., Ltd., Japan), was accompanied by a 3-axis accelerometer PV-83C (Rion Co., Ltd.) and it was placed on solid soil ground. Vertical vibration (Z axis), L_v, was measured every 10 minutes within the adaptable range of (10-70) dB at NV-1 and (10-70) dB at NV-2 and recorded to a memory card.
The measurement period of noise and vibration was 24 hours for each monitoring point. The status of the noise and vibration level monitoring on NV-1 and NV-2 are shown in Figure 2.3-1.

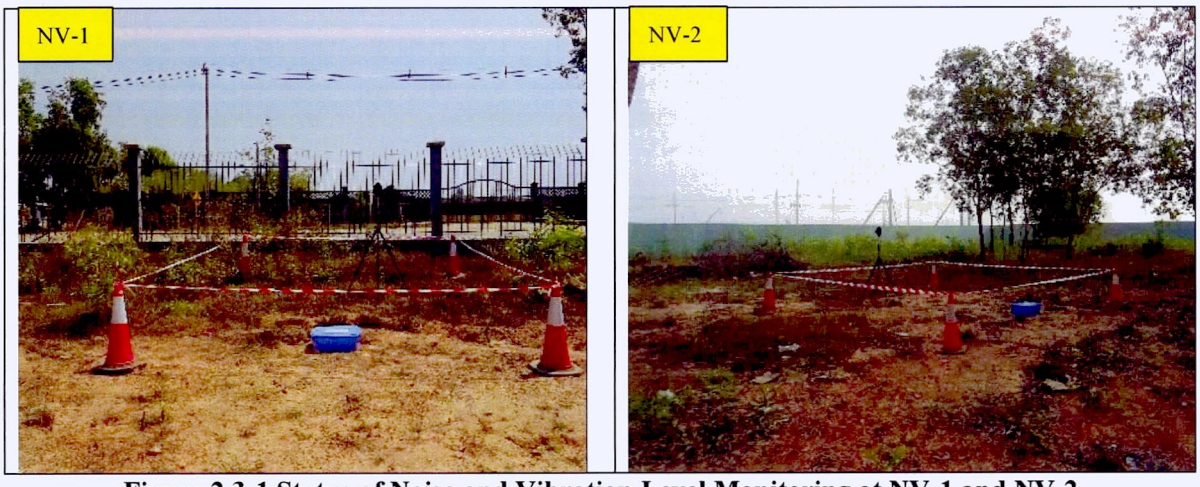

Figure 2.3-1 Status of Noise and Vibration Level Monitoring at NV-1 and NV-2

2.4 Monitoring Results

Noise Monitoring Results

Noise monitoring results are separated as daytime (6:00 AM to 10:00 PM) and evening time (10:00 PM to 6:00 AM) time frames for NV-1 and daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM) and night time (10:00 PM to 7:00 AM) time frames respectively for NV-2. Noise measurement was carried out for one location on a 24-hour basis. The monitoring results are summarized in Table 2.4-1 and Table 2.4-2. Hourly noise level (LA_{eq}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-3 and Table 2.4-4. Figure 2.4-1 and Figure 2.4-2 showed the results of noise level (LA_{eq}) at NV-1 and NV-2. Comparing with the target value of noise level in construction stage prescribed in EIA report for Thilawa SEZ development project Zone B, all results were under the target values.

Table 2.4-1 Results of Noise Levels (LA_{eq}) Monitoring at NV-1

Date	(Traffic Noise Level) Equivalent Noise Level (LA_{eq}, dB)	
	Day Time (6:00 AM – 10:00 PM)	Night Time (10:00 PM – 6:00 AM)
12 – 13 March 2019	62	51
Target Value	75	70

Note: Target value is applied to the noise standard along main road stipulated in the Noise Regulation Law (Japan) (Law No. 98 of 1968, Latest Amendment by Law No.91 of 2000).

Table 2.4-2 Results of Noise Levels (LA_{eq}) Monitoring at NV-2

Date	(Residential area & monastery located less than 150m from the construction site) Equivalent Noise Level (LA_{eq}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
13 – 14 March 2019	62	48	46
Target Value	75	60	55

Note: Target value is applied to the noise level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

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Table 2.4-3 Hourly Noise Level (LA_{eq}) Monitoring Results at NV-1

Date	Time	(LA_{eq}, dB)	(LA_{eq}, dB) Each Category	(LA_{eq}, dB) Target Value	Remark
12 - 13 March 2019	6:00-7:00	68	62	75	No construction Activities
	7:00-8:00	62			
	8:00-9:00	63			Construction activities of Zone B (Pond level & slope trimming work, backfilling, landfilling, land grading, compaction works, excavation works, etc.,)
	9:00-10:00	61			
	10:00-11:00	60			
	11:00-12:00	60			
	12:00-13:00	59			
	13:00-14:00	59			
	14:00-15:00	60			
	15:00-16:00	60			
	16:00-17:00	60			
	17:00-18:00	63			
	18:00-19:00	61			
	19:00-20:00	56			
	20:00-21:00	58			No construction Activities
	21:00-22:00	54			
	22:00-23:00	54	51	70	
	23:00-24:00	51			
	24:00-1:00	53			
	1:00-2:00	50			
	2:00-3:00	51			
	3:00-4:00	47			
	4:00-5:00	45			
	5:00-6:00	52			

Table 2.4-4 Hourly Noise Level (LA_{eq}) Monitoring Results at NV-2

Date	Time	(LA_{eq}, dB)	(LA_{eq}, dB) Each Category	(LA_{eq}, dB) Target Value	Remark
13 - 14 March 2019	7:00-8:00	53	62	75	No construction Activities
	8:00-9:00	63			
	9:00-10:00	62			Construction activities of Zone B (Pond level & slope trimming work, backfilling, landfilling, land grading, compaction works, excavation works, etc.,)
	10:00-11:00	60			
	11:00-12:00	57			
	12:00-13:00	48			
	13:00-14:00	59			
	14:00-15:00	60			
	15:00-16:00	65			
	16:00-17:00	65			
	17:00-18:00	66			
	18:00-19:00	46			
	19:00-20:00	49	48	60	
	20:00-21:00	49			No construction Activities
	21:00-22:00	46			
	22:00-23:00	49	46	55	
	23:00-24:00	47			
	24:00-1:00	47			
	1:00-2:00	43			
	2:00-3:00	44			
	3:00-4:00	40			
	4:00-5:00	45			
	5:00-6:00	46			
	6:00-7:00	48			

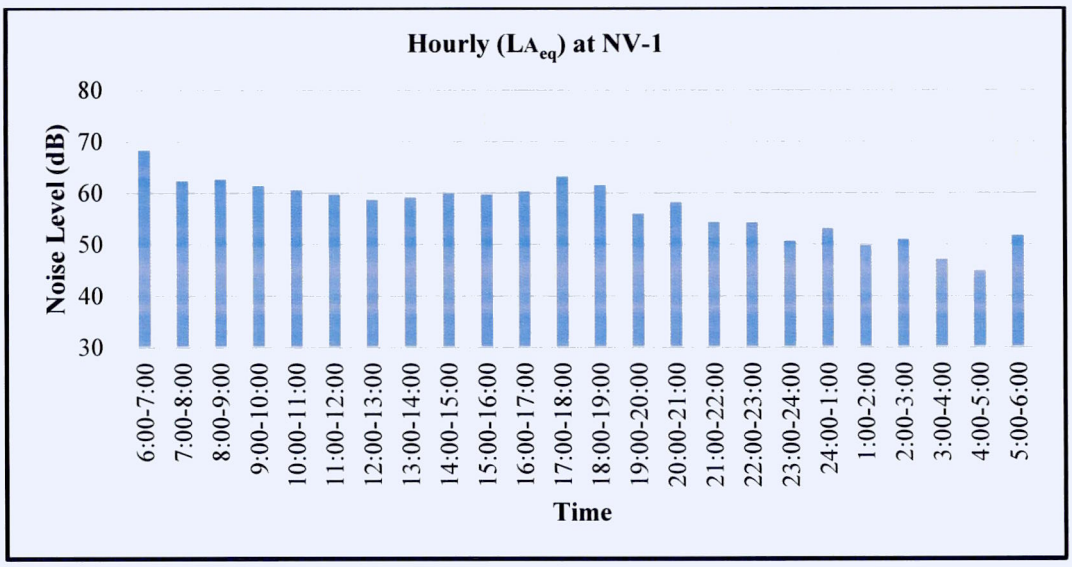

Figure 2.4-1 Results of Noise Levels (LA_{eq}) Monitoring at NV-1

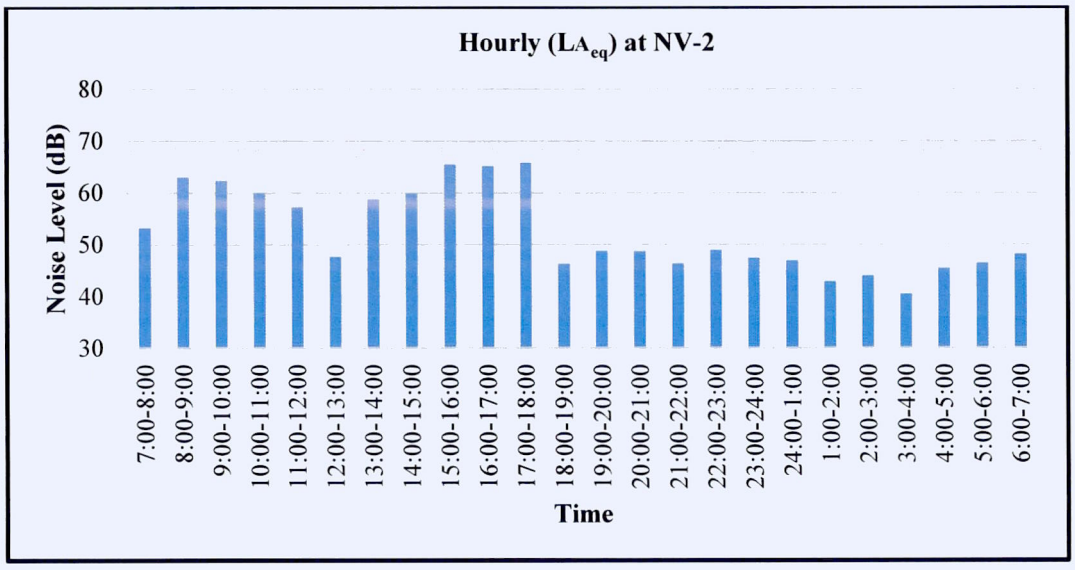

Figure 2.4-2 Results of Noise Levels (LA_{eq}) Monitoring at NV-2

Vibration Monitoring Results

Vibration monitoring results are separated as daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM) and night time (10:00 PM to 7:00 AM) time frames respectively for both NV-1 and NV-2. Vibration measurement was carried out for one location on a 24-hour basis. The results of vibration level (L_{v10}) monitoring at NV-1 and NV-2 are shown in Table 2.4-5 and Table 2.4-6. Hourly vibration level (L_{v10}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-7 and Table 2.4-8. Figure 2.4-3 and Figure 2.4-4 showed the graph of vibration level monitoring results at NV-1 and NV-2. By comparing with the target vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all of results were under the target values.

Table 2.4-5 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

Date	(Residential and commercial and industrial areas) Equivalent Vibration Level (L_{v10}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
12 – 13 March 2019	41	36	33
Target Value	70	70	65

Note: Target value is applied to the vibration level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

Table 2.4-6 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

Date	(Monastery and residential area) Equivalent Vibration Level (L_{v10}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
13 – 14 March 2019	31	27	18
Target Value	65	65	60

Note: Target value is applied to the vibration level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

Table 2.4-7 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-1

Date	Time	(L_{v10}, dB)	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
13 - 14 March 2019	7:00-8:00	40	41	70	No construction Activities
	8:00:9:00	40			
	9:00-10:00	41			Construction activities of Zone B (Pond level & slope trimming work, backfilling, landfilling, land grading, compaction works, excavation works, etc.,)
	10:00-11:00	41			
	11:00-12:00	40			
	12:00-13:00	39			
	13:00-14:00	40			
	14:00-15:00	40			
	15:00-16:00	42			
	16:00-17:00	41			
	17:00-18:00	42			
	18:00-19:00	40			
	19:00-20:00	36	36	70	
	20:00-21:00	38			No construction Activities
	21:00-22:00	32			
	22:00-23:00	30	33	65	
	23:00-24:00	35			
	24:00-1:00	27			
	1:00-2:00	28			
	2:00-3:00	24			
	3:00-4:00	22			
	4:00-5:00	33			
	5:00-6:00	31			
	6:00-7:00	40			

Table 2.4-8 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-2

Date	Time	(L_{v10}, dB)	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
13 - 14 March 2019	7:00-8:00	27	31	65	No construction Activities
	8:00:9:00	33			
	9:00-10:00	33			Construction activities of Zone B (Pond level & slope trimming work, backfilling, landfilling, land grading, compaction works, excavation works, etc.,)
	10:00-11:00	35			
	11:00-12:00	29			
	12:00-13:00	26			
	13:00-14:00	30			
	14:00-15:00	31			
	15:00-16:00	30			
	16:00-17:00	33			
	17:00-18:00	31			
	18:00-19:00	30			
	19:00-20:00	31	27	65	
	20:00-21:00	22			No construction Activities
	21:00-22:00	22			
	22:00-23:00	19	18	60	
	23:00-24:00	19			
	24:00-1:00	18			
	1:00-2:00	16			
	2:00-3:00	17			
	3:00-4:00	15			
	4:00-5:00	17			
	5:00-6:00	20			
	6:00-7:00	21			

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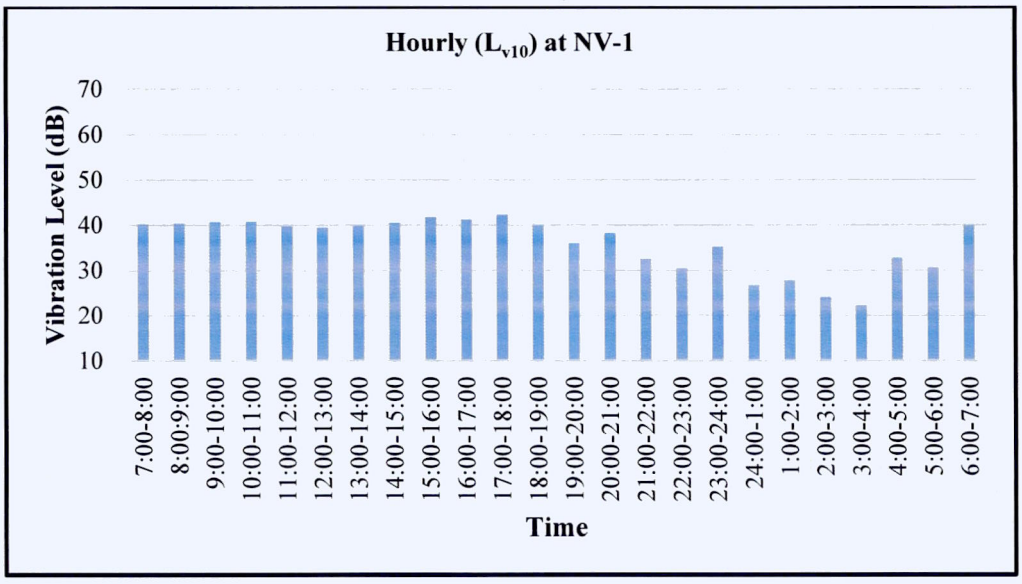

Figure 2.4-3 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

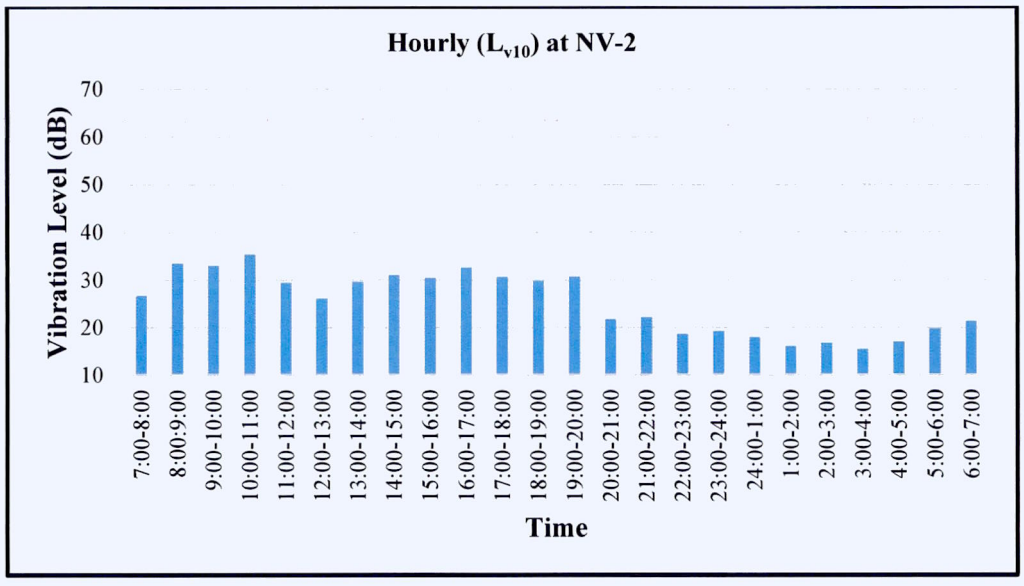

Figure 2.4-4 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

CHAPTER 3: CONCLUSION AND RECOMMENDATION

By comparing with the target noise and vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all results were under the target values at NV-1 and NV-2. As for the detailed analysis of noise level at NV-1 and NV-2 on 24 hours, all results were under the target value. The results of vibration level for NV-1 and NV-2 are also lower than the target levels. Thus, there is no negative impact on noise and vibration from construction activities of Zone B to the surrounding environment.

In conclusion of this environmental monitoring, there are no specific noise and vibration impacts to the surrounding area of industrial area of Thilawa SEZ Zone B during the monitoring period.

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Traffic Volume Monitoring Report

March 2019

TRAFFIC VOLUME MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd., (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, Traffic volume had been monitored from 12 March 2019 to 13 March 2019 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
12 March 2019 - 13 March 2019	Traffic Volume	-	1 (TV-1)	24 hours	Manual Count

CHAPTER 2: TRAFFIC VOLUME MONITORING

2.1 Monitoring Item

The traffic volume monitoring item are shown in Table 2.1-1. All vehicles were classified into four types as detailed in Table 2.1-2.

Table 2.1-1 Monitoring Parameters for Traffic Volume

No.	Item	Parameter
1	Traffic volume	Number of Vehicle (4 Types)

Table 2.1-2 Classification of Vehicles Types

No.	Classification		Description
1	Two-wheeled vehicle		Motorbike, Motorcycle taxi
2	Four-wheeled light vehicle	  	Pick-up car, Jeep, Taxi, Saloon car, Light truck (under 2 tons)
3	Four-wheeled heavy vehicle	  	Medium bus, Express, Big bus, Medium truck, Heavy truck
4	Others		Tractor

2.2 Monitoring Location

Traffic volume was measured at the northeast corner of the Thilawa SEZ Zone B, monitoring point (TV-1); N: 16°40'17.90", E: 96°17'18.20". The location of the traffic volume monitoring point is shown in Figure 2.2-1.

Figure 2.2-1 Location of Traffic Volume Monitoring Point

TV-1

TV-1 is located in front of main gate of construction site of Thilawa SEZ Zone B and next to Thilawa Development road. The surrounding area are Zone A in the northwest and local industrial zone in the east respectively.

2.3 Monitoring Method

The traffic volume monitoring was conducted for 24 hours at the same time as the traffic noise and vibration level monitoring. Traffic volume monitoring was conducted to count the numbers of vehicles moving in each direction. Manual count method was used and data was recorded using tally sheets. The status of the traffic volume monitoring on TV-1 is shown in Figure 2.3-1.

Figure 2.3-1 Status of Traffic Volume Monitoring at TV-1

2.4 Monitoring Results

The traffic volume monitoring results are summarized in Table 2.4-1. Hourly quantities of each type of vehicle were recorded. The Table 2.4-1 shows that the number of 2-wheel vehicles are distinctly and highly utilized in weekdays. The number of 4-wheel heavy vehicles are two times lower than the number of 4-wheel light vehicles for each direction.

Table 2.4-1 Summary of Traffic Volume Recorded at TV-1

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Phalan village to Dagon-Thilawa road	12 March 2019 - 13 March 2019	Tuesday & Wednesday	2484	916	377	68	3845
	Dagon-Thilawa road to Phalan village			2618	970	362	57	4007

The summary monitoring results of hourly traffic volume at TV-1 is shown in Table 2.4-2 and Table 2.4-3 respectively. Compare the result of each direction in morning peak hours as 6:00 to 9:00 and in the evening peak hours as 16:00 to 18:00, traffic volume from Phalan village to Dagon-Thilawa road is higher than another direction in the morning peak hours. In the evening peak hours, traffic volume from Dagon Thilawa road to Phalan village is higher than another direction. It is possible that the commuting vehicles are passing from Phalan village to Dagon-Thilawa road in the morning peak hours and returning from Dagon Thilawa road to Phalan village in the evening peak hours in this monitoring period.

Table 2.4-2 Hourly Traffic Volume Results at TV-1 (From Phalan Village to Dagon-Thilawa Road)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
11:00	12:00	123	57	23	4	207
12:00	13:00	128	59	26	4	217
13:00	14:00	97	61	19	4	181
14:00	15:00	92	60	28	4	184
15:00	16:00	80	63	31	7	181
16:00	17:00	105	51	25	3	184
17:00	18:00	315	94	30	10	449
18:00	19:00	270	76	32	8	386
19:00	20:00	82	24	4	2	112
20:00	21:00	92	32	15	0	139
21:00	22:00	43	14	4	1	62
22:00	23:00	38	15	8	1	62
23:00	0:00	2	6	3	0	11
0:00	1:00	2	2	12	0	16
1:00	2:00	7	4	2	0	13
2:00	3:00	4	1	2	0	7
3:00	4:00	3	3	1	0	7
4:00	5:00	3	2	1	0	6
5:00	6:00	15	7	1	0	23
6:00	7:00	107	26	2	2	137
7:00	8:00	495	67	14	3	579
8:00	9:00	199	65	38	4	306
9:00	10:00	96	67	26	5	194
10:00	11:00	86	60	30	6	182
Total		2484	916	377	68	3845

Table 2.4-3 Hourly Traffic Volume Results at TV-1 (From Dagon-Thilawa Road to Phalan Village)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
11:00	12:00	100	66	26	2	194
12:00	13:00	125	67	22	2	216
13:00	14:00	129	81	24	3	237
14:00	15:00	95	71	29	3	198
15:00	16:00	88	63	24	4	179
16:00	17:00	127	58	21	5	211
17:00	18:00	369	63	26	9	467
18:00	19:00	284	54	21	4	363
19:00	20:00	95	18	5	0	118
20:00	21:00	105	34	13	0	152
21:00	22:00	37	16	6	0	59
22:00	23:00	36	13	5	2	56
23:00	0:00	3	2	1	0	6
0:00	1:00	4	2	12	0	18
1:00	2:00	7	5	1	0	13
2:00	3:00	2	1	4	0	7
3:00	4:00	5	2	1	0	8
4:00	5:00	3	2	0	0	5
5:00	6:00	13	10	3	1	27
6:00	7:00	77	9	4	2	92
7:00	8:00	465	106	29	8	608
8:00	9:00	214	59	18	4	295
9:00	10:00	123	93	30	2	248
10:00	11:00	112	75	37	6	230
Total		2618	970	362	57	4007

The summary of traffic volume results during quarterly monitoring at TV-1 is shown in Table 2.4-4 and Table 2.4-5 respectively. In the summary traffic volume results during quarterly monitoring surveys at TV-1, comparison of traffic volume results for more than two years was described. Among the traffic monitoring surveys (quarterly), traffic volume results for September 2017 is the lowest compared with other quarterly monitoring surveys. Traffic volume results are increasing start from December 2017. Traffic volume results of March 2019 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and from Dagon Thilawa Road to Phalan village.

Table 2.4-4 Summary of traffic volume results during quarterly monitoring surveys at TV-1 (From Phalan Village to Dagon Thilawa Road)

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Phalan village to Dagon-Thilawa road	29 Mar-30 Mar 2017	Wednesday & Thursday	1,712	545	216	29	2,502
		22 June-23 June 2017	Thursday & Friday	1,402	528	352	47	2,329
		19 September-20 September 2017	Tuesday & Wednesday	1,254	509	393	17	2,173
		7 December-8 December 2017	Thursday & Friday	1,800	652	339	43	2,834
		15 March 2018 – 16 March 2018	Thursday and Friday	2,210	830	360	52	3,452
		5th June 2018 – 6th June 2018	Tuesday & Wednesday	2,253	847	323	54	3,477
		5 September 2018 – 6 September 2018	Wednesday & Thursday	2146	826	242	41	3255
		11 December 2018 – 12 December 2018	Tuesday & Wednesday	2404	865	371	50	3690
		12 March 2019 – 13 March 2019	Tuesday & Wednesday	2484	916	377	68	3845

Table 2.4-5 Summary of traffic volume results during quarterly monitoring surveys at TV-1 (From Dagon-Thilawa Road to Phalan Village)

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Dagon-Thilawa road to Phalan village	29 Mar-30 Mar 2017	Wednesday & Thursday	1,534	500	236	28	2,298
		22 June-23 June 2017	Thursday & Friday	1,291	542	357	43	2,233
		19 September-20 September 2017	Tuesday & Wednesday	1,195	486	372	19	2,072
		7 December-8 December 2017	Thursday & Friday	1,695	682	322	40	2,739
		15 March 2018 – 16 March 2018	Thursday and Friday	2,062	812	312	48	3,234
		5 June 2018 – 6 June 2018	Tuesday & Wednesday	2,048	799	322	52	3,221
		5 September 2018 – 6 September 2018	Wednesday & Thursday	2117	865	250	41	3273
		11 December 2018 – 12 December 2018	Tuesday & Wednesday	2388	944	384	65	3781
		12 March 2019 – 13 March 2019	Tuesday & Wednesday	2618	970	362	57	4007

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The results of the traffic volume show that the number of 2-wheel vehicles are distinctly and highly utilized in this monitoring period. The number of 4-wheel heavy vehicles are significantly lower than the number of 4-wheel light vehicles for each direction. It seems that commuting vehicles are much utilized during this monitoring period as compare with construction related vehicles (4-wheel heavy vehicles). By comparing the previous quarterly traffic surveys, the traffic volume is increasing start from December 2017. Traffic volume results of March 2019 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and from Dagon Thilawa Road to Phalan village.

The continuous monitoring will be necessary to grasp the traffic volume data in construction stage of Thilawa SEZ Zone B. Once enough traffic volume data is collected, the mitigation measures for traffic volume management will be considered in future.

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